

NAVAL POSTGRADUATE SCHOOL

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THESIS

**THE CAPABILITY OF THE AIR MOBILITY FLEET TO
ADEQUATELY SUPPORT ARMY TRANSFORMATION
REQUIREMENTS**

by

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**THE CAPABILITY OF THE AIR MOBILITY FLEET TO ADEQUATELY
SUPPORT ARMY TRANSFORMATION REQUIREMENTS**

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ABSTRACT

The current plan to procure only 134 C-17 Globemaster III aircraft to replace the C-141 fleet will not meet U.S. wartime requirements for core strategic airlift. Although the C-17 is now exceeding design expectations, the fleet will not provide enough core airlift volume for the United States in the 21st Century.

The Army will support Phase I of the Army transformation as it stands up two Initial Brigade Combat Teams. These brigades will have the capability of being deployed anywhere in the world in 96 hours from first aircraft wheels up. Units are being formed with off-the-shelf capabilities and lessons learned from operational experience and the Army's Experimentation Campaign Plan. This thesis examines the ability of our current and future airlift fleet to project and sustain U.S. power abroad as changes are identified in the Army's Transformation process.

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LIST OF ACRONYMS

AE	Areomedical Evacuation
AFRES	Air Force Reserve
AFLOCS	Air Lines of Communication
ANG	Air National Guard
BURU	Bottom-Up Review
CBO	Congressional Budget Office
CONUS	Continental United States
CRAF	Civil Reserve Air Fleet
CSA	Combat Support Activity
DOD	Department of Defense
FCS	Future Combat Systems
IBCT	Interim Brigade Combat Team
IPS	Illustrative Planning Scenarios
JFLCC	Joint Forces Land Component Command
LMSR	Larger Medium Speed Roll on/Roll off Ship
MRC	Major Regional Conflict
MRS	Mobility Requirement Study
MTM/D	Million Ton Miles Per Day
MTW	Major Theater War
NMS	National Military Strategy
OPTEMPO	Operations Tempo
PERSTEMPO	Personnel Tempo
RSTA	Reconnaissance Surveillance Target Acquisition
SASO	Stability and Support Operations
SOF	Special Operations Force
SSC	Smaller Scale Contingency
TAA	Tactical Assessment Area
USTRANSCOM	US Transportation Command

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I. INTRODUCTION

A. BACKGROUND

Mobility forces are the air, sea and ground systems that transport military personnel and material throughout the world. They include airlift and sealift, as well as road and rail systems. Airlift provides a rapid and flexible means of deploying and sustaining forces, as well as fuel and supplies. In many instances, deploying forces are able to draw on equipment and material prepositioned at sea or on land near the location of a crisis, so prepositioning is also considered a mobility program. Aerial-refueling forces contribute to mobility by permitting the nonstop deployment of tactical air and bomber forces and by extending the range of airlift aircraft when en route bases are not available. In operations ranging from humanitarian relief to combat, mobility forces enable the United States to deploy forces quickly and sustain them until their mission is complete. The draw down of U.S. troop strength overseas and the increasing number of unstable situations abroad combine to place a high value on mobility forces.

Mobility forces would be the key to the deployment and sustainment of U.S. forces in any major regional conflict (MRC). Should conflict erupt with little warning, the United States would want to respond promptly with sufficient strength to help forces halt aggression and restore peace. Airlift, augmented by prepositioning, would carry out the initial deployments. These first flights would deliver primarily aviation and light ground forces, plus some heavier ground elements. The remaining heavy combat forces would deploy by sea.

Military interventions and peace operations still place heavy demands on mobility forces. As in larger contingencies, mobility forces contribute both to the deployment and sustainment of forces. Depending on the location, significant amounts of material must be moved, particularly if troops are sent where the infrastructure is limited and host nation support is either lacking or not available.

The 1992 Mobility Requirements Study (MRS) established mobility requirements for the post-Cold War era. It defined the baseline requirements for intertheater (or

strategic) mobility and proposed a long-range investment plan to meet them. Specifically, the study validated the need of 120 C-17 aircraft and called for the acquisition of additional medium-speed sealift vessels and afloat prepositioning ships.

A follow-on study, conducted in 1994, updated the original MRS findings to reflect changes in force structure and warfighting strategy resulting from the 1993 Bottom-Up Review or MRS BURU. The 1994 analysis affirmed the need for increases in key mobility components. The MRS BURU examined intertheater airlift requirements in detail. Based on the findings, DoD has established an intertheater airlift objective of between 49 to 52 million ton-miles per day of cargo capacity. The precise amount of airlift needed will depend on the level of prepositioning that can be achieved overseas. As a result of DoD continuing to evaluate prepositioning options, the airlift objective will continually change.

Airlift investments in the future have focused on replacing aging fleet intertheater aircraft. A decision that has been reached by the Defense Acquisition Board (DAB) shows that at least a 120-aircraft C-17 force would be needed to meet strategic and tactical mission requirements at an acceptable level of risk. Studies have shown that the 120-aircraft C-17 force will provide the greatest amount of flexibility in meeting airlift requirements, at a cost only slightly higher than the other alternatives that met the requirements.

The C-17 is the appropriate alternative to meet America's future airlift requirements. We must ensure the numbers are able to meet our needs. The C-17 completed the most rigorous evaluation of reliability, maintainability and availability ever conducted on a military airlift aircraft and its performance far exceeded expectations.

B. PURPOSE

This purpose of this thesis is to analyze the ability of our current and future airlift fleet to project and sustain U.S. power abroad as changes are identified in the Army's Transformation process. The current plan to procure only 134 C-17 Globemaster III aircraft to replace the C-141 fleet will not meet U.S. wartime requirements for core strategic airlift. Although the C-17 is now exceeding design expectations, the fleet will

not provide enough volume core airlifts for the United States in the 21st Century. Fortunately the C-17's ability to meet strategic airlift specifications, once arguable, is no longer a question.

The Army will support Phase I of the Army Transformation as it stands up two Initial Brigade Combat Teams. These brigades will have the capability of being deployed anywhere in the world in 96 hours from first aircraft wheels up. Units are being formed with off-the-shelf capabilities and lessons learned from operational experience and the Army's Experimentation Campaign Plan.

C. RESEARCH QUESTIONS

1. Primary Research Question

- Can the current air mobility fleet meet our present national security Objectives?

2. Secondary Research Questions

- Will the current air mobility force structure continue to be appropriate in the face of evolving strategy?
- What will be the impact of strategic airlift on the Army Transformation Process?
- How have changing missions affected air mobility requirements?
- What are the limitations to our airlift requirements today as the Army's Transformation campaign takes affect?

D. SCOPE

This research will examine the fundamental areas of airlift planning and operations. The initial focus will explore the airlift requirements for both current and future airlift fleets. Next, in order to meet these requirements, the report shifts toward the airlift fleet capabilities with the C-17 as the primary core airlifter. Then a review of wartime and peacetime operations reveals how lift capability is degraded over the life of airlift systems. Finally, this research examines how the Army's transformation impacts the air mobility requirements. This paper will conclude with recommendations for developing a realistic core airlift fleet.

E. METHODOLOGY

I will use current published documentation and literature to provide the basis for answering the research questions in paragraph C. In addition, I will conduct personal interviews with subject matter experts to further clarify and expand on information extracted from published documentation and literature.

I will conduct literature search of pertinent transportation and logistic books and magazine articles, Department of Defense and Navy Publications, CD-ROM systems, and other library information to obtain information relevant to the capabilities and limitations of the existing air mobility requirements and specific requirements in identifying the Army Transformation requirements.

F. ORGANIZATION OF THE STUDY

This thesis is organized into five chapters. Following the introduction to the research area in Chapter I, Chapter II highlights the underestimation of airlift needed to deploy and sustain U.S. forces in major regional conflicts around the world. Chapter III examines airlift to the extent to which current and future assets meet projected requirements. Chapter IV examines the Army's intent to quickly field brigades that are strategically responsive, rapidly deployable, agile, versatile, lethal, survivable and sustainable. The final chapter will provide a summary, conclusion, and recommendations.

II. STRATEGIC AIRLIFT TODAY

A. INTRODUCTION

In the aftermath of the Cold War, many military analysts believe that strategic mobility--the system of equipment, personnel, and logistical know-how for moving military forces over intercontinental distances--is more important than ever before. The Department of Defense (DoD) has reduced the number of U.S. troops stationed abroad, so the United States will need to deploy forces over a longer distance if it becomes involved in a foreign conflict. The ability to project large numbers of forces quickly has been a distinctive feature of the U.S. military. In the opinion of some analysts, it is one means of maintaining the nation's status as a superpower. [Ref. 1]

Worldwide mobility for U.S. military forces is a fundamental precept in our national security strategy of engagement and enlargement. Our strategy calls for the preparation and deployment of American military forces in the United States and abroad to support U.S. diplomacy in responding to key dangers -- those posed by weapons of mass destruction, regional aggression and threats to the stability of states. Enhancement of our strategic mobility capability, including airlift, sealift, and pre-positioning, is already underway. We have taken delivery of the first 18 of the initial procurement of C-17 advanced transport aircraft. One Army heavy brigade's equipment set is pre-positioned aboard ships now on station to cover contingencies from Northeast Asia to the Persian Gulf. Our plans call for three additional brigade sets to be pre-positioned ashore, two in Southwest Asia and one in South Korea. [Ref 1]

Airlift operates across the range of military operations performing six broad tasks: deployment, employment, redeployment, sustainment, areomedical evacuation (AE), and military operations other than war, such as foreign humanitarian assistance and noncombatant evacuation operations. Airlift is a cornerstone of global force projection. It provides the means to rapidly deploy and redeploy forces, on short notice, to any location worldwide. Airlift's characteristics — speed, flexibility, range, and responsiveness — complement other US mobility assets. The United States operates three distinct airlift forces; intertheater or strategic, theater or intratheater, and organic airlift forces. Airlift

delivery is accomplished by two basic modes, air land or aerial delivery. Air land is the most frequently used delivery method and encompasses all situations where personnel and cargo are onloaded and off-loaded while the aircraft is on the ground. Aerial delivery includes all methods of delivering personnel, equipment, and supplies from an airborne aircraft.

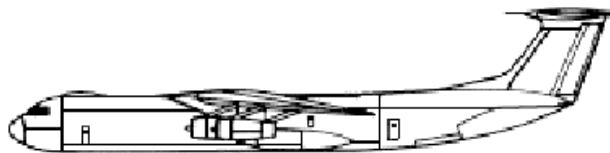
The Army has the largest requirement for common-user airlift. In particular, Army light infantry, airborne, and air assault forces rely heavily on airlift for deployment, sustainment, employment, and redeployment. The Navy depends on common-user airlift to sustain forward deployed operations with personnel, materiel, and mail from the continental United States (CONUS) to overseas bases and forward logistics sites. Marine forces require common-user airlift for deployment into a theater as part of a maritime prepositioning force, as an air contingency force, or as a Marine expeditionary force afloat and/or ashore. Sustained Marine air-ground task force operations require strategic and intratheater common-user airlift support. Depending on the operation, the Air Force tends to be the second largest customer of common-user airlift. For deployment, Air Force unit aircraft self-deploy; however, unit support personnel and equipment require airlift to the destination with, or before, the deploying unit aircraft. Special operations forces (SOF) have specially configured aircraft dedicated to special operations. SOF are augmented by common-user airlift support. As a branch of the Armed Forces and a non-DOD agency, the Coast Guard's organic airlift is normally sufficient to satisfy its airlift requirements. Other non-DOD agencies use DOD airlift for activities such as noncombatant evacuation operations, counterdrug operations, foreign humanitarian assistance, and domestic support operations. Non-DOD agencies may use common-user airlift providing the DOD mission is not impaired. [Ref. 2:p. 7]

Today, the ability to meet the operational objectives of power projection and force sustainment from the continental United States is the heart of the issue. Because of this importance, air mobility has emerged as a crucial element in promoting the U.S. National Security Strategy of engagement and enlargement. National security strategy depends on air mobility to protect America's global interest. As our nation moves away from forward overseas basing, we face the rapid mobility demands that a CONUS based,

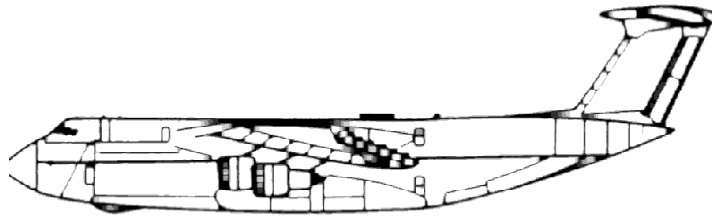
expeditionary military presents. To that end, airlift delivers the majority of the initial time-critical forces and war material to regional hot spots in support of expeditionary operations. To meet these strategic needs, the United States armed forces rely on a core airlifter to accomplish both peacetime and contingency tasking.

Today's airlift fleet is made up of both planes that are dedicated solely to military missions and commercial aircraft that are part of the Civil Reserve Air Fleet (CRAF). If mobilized fully, the combined fleet would have a total theoretical airlift capacity of almost 50 million ton-miles per day. Nearly two-thirds of that amount comes from the military's own planes, with the rest contributed by civil carriers. [Ref. 3:Sec. 4]

DoD's current fleet of strategic airlifters includes three types of cargo planes and two varieties of tanker aircraft. Tankers are generally used to refuel other aircraft while in flight, but DoD needs fewer planes for that role today than it did during the Cold War because there is less call for long-range missions by strategic nuclear bombers. Thus, military officials plan to use some tankers for airlift missions. Military cargo planes such as the C-141, C-5, and C-17 have special features that make them particularly well suited to moving military equipment, Figure 1. The C-5 and C-17 also have large doors and unobstructed cargo compartments that can carry the largest or most awkwardly shaped pieces of military equipment, such as tanks and helicopters. Military transports also have multiple sets of electrical and mechanical systems and other safety features so they can continue to operate even if damaged in battle. [Ref. 1:p. 13]



The C-141 can carry an average payload of 23 tons. It is the primary plane the Air Force would use to airdrop personnel and supplies over long distances. First built in the 1960s, the average C-141 is nearly 30 years old. The Air Force plans to retire the planes from service by 2007.



With an average load of 65 tons, the C-5 is the largest of DoD's military airlift planes. Unlike the C-141, the C-5 was built to carry the biggest pieces of military equipment (called outsize cargo), such as M1 tanks. It has doors and ramps at both nose and tail so cargo can be loaded more quickly.



Figure 1. DoD's Strategic Airlift Planes.
SOURCE: Congressional Budget Office.

The C-17 is DoD's newest transport plane. Like the C-5, it can carry outsize cargo. However, it is closer in length to the C-141, so its average payload is smaller than the Galaxy's--45 tons. DoD says the C-17's size and maneuverability on the ground give it an advantage over larger planes when airfields are congested.

By contrast, KC-10 and KC-135 tankers are modified versions of civil planes. Because of intense competition in the market for commercial airliners, civil transports are designed to carry loads of passengers, baggage, and cargo as cost-effectively as possible. With narrower cargo holds and smaller doors, civil transports are better suited for moving bulk cargo on standard-size pallets. On the down side, they require special elevators for loading and unloading since their cargo doors are higher off the ground. They also need longer runways than may be found in some parts of the world. But modern civil transports, such as the Boeing 747, are very reliable and can carry larger payloads over a longer range without refueling than most military airlift planes. [Ref: 1:Sec. 2]

B. PROBLEM DEFINITION

With fewer combat units stationed abroad today, the United States needs strategic mobility forces to project its military might. But when federal funding is tightly constrained, it is important to revisit the issues of how much strategic mobility is enough and what mix of lift forces best suits the United States needs.

Since the end of the Persian Gulf War, the Office of the Joint Chiefs of Staff has coordinated three analyses of the U.S. military's strategic lift needs: the 1992 Mobility Requirements Study, the 1994 Mobility Requirements Study Bottom-Up Review Update (MRS BURU) and Mobility Requirement Study 2005. Rather than looking at a broad range of scenarios in which the United States might need to move its forces, both analyses focused on a few scenarios that military planners believe will place the greatest demands on strategic mobility. However, because determining future lift requirements involves making a host of assumptions, the results of those and similar analyses are bound to be contentious. [Ref. 4]

Airlift requirements set by DoD planners during the Cold War provide an example. During the early 1980s, DoD set a goal of purchasing 66 million ton-miles per day of airlift capacity--more than twice the level that existed at the time. The Congress invested considerable money to achieve that goal, including funds to buy C-5Bs and KC-10s and to develop the C-17. But that substantial investment left DoD far short of its goal, with around 50 MTM/D of airlift capacity. And even the 66 MTM/D goal was not nearly large enough to address what defense officials thought they would need for a conflict with the Soviet Union; that level was lowered because of fiscal realities.

Today, the Air Force's airlifters are enormous, and it is they who haul the Army's biggest vehicles, rather than the other way around. Moreover, experts predict, tomorrow's transports will be able to haul massive loads to any point on Earth within an hour, defend themselves en route, and land on parking lots.

The C-141 aircraft, which has been the backbone of the military's airlift fleet, is nearing the end of its service life and has been under severe flight restrictions in recent years. The Air Mobility Command has temporarily expanded the use of commercial and

tanker aircraft for regularly scheduled cargo and passenger missions. It also plans to upgrade its strategic airlift simulator capacity, which will allow it to do more in-aircraft training. The Command, however, can do more. First, it can continue to use commercial and tanker aircraft to fly scheduled missions not requiring the unique capabilities of the C-141. Second, the Command can make maximum use of the upgraded simulators by transferring more of the air refueling and local proficiency training from the C-5 and C-141. Moreover, it can institute a companion trainer aircraft program for the C-5 and C-141. This program involves flying smaller, less-costly aircraft for training that does not require larger aircraft; this would be similar to programs that the Air Force and Command have for tanker aircraft. [Ref. 6]

With about 190 operating, the C-141 is the most common airlift plane in the military fleet. Those aircraft provide nearly 9 million ton-miles per day (MTM/D) of theoretical capacity--slightly less than a third of the total for military airlift planes in 1996. The Air Force considers the C-141 its core airlifter because the plane can be used not only to deliver cargo but also to conduct special military missions such as air-dropping Army paratroopers and their equipment.

But the C-141 is reaching the end of its service life, and recent experience has led military leaders to question its reliability. In 1993, an Air Force advisory board recommended restricting the weight of cargo that each plane can carry. Inspection of the C-141 fleet revealed cracks in the weep holes where fuel circulates within the plane's wings, and in some wing boxes that secure the wings to the fuselage. The Air Force repaired some of its C-141s to retain fleet capacity over the next few years, but it also decided to accelerate the plane's retirement. Current plans call for withdrawing the C-141 from active forces by 2003 and from reserve components by 2007.

Because of the sheer number of C-141s in service, that plane has been considered the workhorse of the military's strategic airlift fleet. But nearly 50 percent of the military's theoretical airlift capacity comes from C-5s. Seventy-six A model aircraft were built during the early 1970s and were retrofitted with new wings during the mid-1980s. Beginning in 1986, the Air Force took delivery of 50 new C-5Bs.

Unfortunately, the C-5 (the older A model in particular) has been plagued by low rates of reliability and maintainability. During the Persian Gulf War, an average of more than 30 percent of the Air Force's C-5s were unavailable because they needed maintenance, lacked spare parts, or both. As it is flown and operated today, a C-5A requires about 56 hours of maintenance for every hour of flight, and the B model needs 29 maintenance hours per flight hour. The Air Force is considering retiring its C-5As beginning in 2007--even though the average C-5A airframe has just 15,000 flight hours out of an expected service life of 30,000 hours. [Ref. 7]

The Administration plans to use 120 C-17's as the replacement workhorse for more than 200 C-141s. As of December 1996, the Air Force had contracted for 48 C-17s. Twenty-four of those are already operating and contribute about 3 MTM/D of DoD's theoretical airlift capacity. The C-17 has a system of thrust-reversers, flaps, and slats that allows it to land on short or ill-equipped airfields much as the C-130 (the Air Force's primary tactical airlift plane). Some military planners would like to use the C-17 to deliver cargo from the United States directly to airfields at the battlefield, rather than transferring equipment from main operating bases by ground transportation or on C-130s. Under the Administration's plan for multiyear procurement, C-17 purchases would cost \$16.1 billion between 1998 and 2002, with the last planes being bought in 2003. [Ref. 1:p. 24]

C. RESOURCE PLANNING

Airlift planners use three different types of planning approaches to accomplish national military objectives: resource planning, deliberate planning, and crisis action planning. Within each of these approaches, models are used to gather and process data to yield usable information on strategic airlift operations. For long-range strategic forecasts, resource planning is the most appropriate tool to accomplish our objectives. Resource planning focuses on the two areas: capabilities and requirements.

The capabilities planning and decrease in force structure are the realities of today's strategic environment. Currently, capability assessments determine our airlift force's ability to meet lift demands from available resources. However, strategic airlift

requirements have to be examined because the DoD places demands on airlift to meet our mobility requirements.

Requirements studies provide the information needed by using historical data and current trends to estimate what our future strategic airlift demands may be. The studies estimate the assets needed to meet our force requirements. Because of their importance the resource planning and requirement studies have been guiding principles in our past.

The 1992 Mobility Requirements Study (MRS) established mobility requirements for the post-Cold War era. It defined baseline requirements for intertheater (or strategic) mobility and proposed a long-range investment plan to meet them.

Specifically, the study validated the need for 120 C-17 aircraft and called for the acquisition of additional medium-speed sealift vessels and afloat prepositioning ships. A follow-on study, conducted in 1994, updated the original MRS findings to reflect changes in force structure and warfighting strategy resulting from the 1993 Bottom-Up Review. The Bottom-Up Review Update, or MRS BURU -- reaffirmed the need for increases in key mobility components. In particular, it validated the original MRS recommendation for the procurement of additional ships for afloat prepositioning and for surge deployments of forces based in the continental United States (CONUS). The MRS BURU also examined intertheater airlift requirements in detail. Based on the study's findings, DoD has established an intertheater airlift objective of between 49 and 52 million ton-miles per day of cargo capacity. The precise amount of airlift needed will depend on the level of prepositioning that can be achieved overseas. The Department is continuing to evaluate prepositioning options, as well as other potential warfighting enhancements, that could result in changes to the airlift objective. [Ref. 4:p. 3]

The requirements established by the MRS BURU were based on an evaluation of mobility force needs for two nearly simultaneous MRCs. Mobility forces would be heavily involved in all phases of a major regional conflict, contributing both to the deployment and sustainment of combat forces. Immediately upon a decision to commit forces, ground units and aviation support elements would be dispatched to the region from bases in the United States and abroad. These forces would deploy by air, and would

draw the bulk of their equipment and supplies from stocks prepositioned for them on land or afloat. They would be joined in the theater by additional Marine ground units arriving on amphibious ships. Combat aircraft would self-deploy, relying on tankers for aerial-refueling support en route to their destination. These early-deploying forces, operating in conjunction with naval units at sea, would mount an initial defense and secure ports and airfields for the arrival of follow-on forces. Studies and war games have confirmed that the prompt availability of forces in a conflict theater is critical not only to the initial defense but to the successful execution of the entire warfighting strategy.

As the buildup continues, heavy combat and support forces would begin arriving by sea, with fast sealift ships making the first deliveries. Airlift would continue moving personnel and high-priority supplies and equipment into the theater. Once sufficient forces were available, a large-scale, air-land counteroffensive would be launched. Mobility forces would provide critical support for this phase of the operation, delivering reinforcements and any additional equipment and supplies needed to sustain combat.

Once the conflict has ended, mobility forces would begin returning U.S. troops to their regular operating locations at home and abroad. Mobility forces also would provide critical support for any residual forces that remained in the theater, delivering the supplies and other material needed to sustain the forces' presence.

While the MRS-BURU assumed that "all allied nations would support mobility operations," it didn't consider that an ally might either contribute some lift capability of its own or deny host nation support, especially if it is under threat of weapons of mass destruction. The MRS-05 will use the concept of "fort-to-foxhole" operations, and include constraints at CONUS bases, the en route system, and the processing capacity at receiving ports overseas. The MRS-BURU focused only on strategic lift, port-to-port, and some en route capacity.

The MRS-05 examined the number and the mix of mobility systems needed to support two nearly simultaneous major theater wars. The MTW scenarios recognized the increased complexity involved in deploying forces from a posture of global engagement and in responding to asymmetric attacks by enemy forces, including attacks using

chemical weapons. MRS-05 constituted an end-to-end analysis, investigating mobility requirements in the continental United States as well as between theaters and within individual theaters.

The programmed 2005 force structure was moved through the 2005-projected defense transportation system according to the deployment schedule reflected in the Illustrative Planning Scenarios (IPS). The timing of unit equipment arrivals and the sustainment necessary to support arriving equipment was assessed using campaign-level ground, naval, and air combat models. Risk was assessed based on the US/coalition forces ability to achieve measurable warfighting objectives. Improvements to the defense transportation system were examined when warfighting outcomes did not meet acceptable criteria. [Ref. 1:p. 23]

The MRS-05 drew on large volumes of data in defining mobility requirements for FY 2005. The Services provided time-phased force deployment data. The data was derived from POM estimates for FY 2005, intelligence assessments, treaties and agreements and war plans.

D. REQUIREMENTS ASSESSMENT

The MRS-05 study identified several areas where improvements were needed. Pre-positioning, surge sealift, inter-theater lift capability and CONUS transportation assets were all within satisfactory areas. As established in the MRS-BURU, an airlift fleet of 49.7 MTM/D was not adequate to meet the full range of requirements. The shortfall was attributed to the newly identified intra-theater lift requirements and to missions in addition to supporting the two MTW scenarios.

The airlift analysis considered a variety of different missions. It reviewed the missions that directly supported the two simultaneous MTWs. From this assessment, the study identified a requirement for 51.1 MTM/D of airlift capability. This figure accounted for deployments to the two theater wars and support for high priority movements within the theaters.

The MRS-05 evaluated the planning assumptions that would affect the availability of airlift in critical peak periods. The study generated an airlift requirement of 67

MTM/D. However, three missions were judged as the highest priority additions to the initial 51.1 MTM/D needed for major theater warfighting. The three high priority missions, conducting special operations, deploying missile defense systems to friendly nations and supporting other theater commanders not directly engaged in the theater, increase the 51.1 MTM/D to 54.5 MTM/D. [Ref. 8:p. 37]

To establish an airlift objective within the range of the analysis, and to develop a program to meet the objective, a balance between capability and a risk of overall defense priorities will have to be considered. DoD must determine the mix of its investment to achieve airlift objectives by investing in C-17's or enhancing the C-5s.

E. CONCLUSION

Every analysis of mobility requires a vast number of assumptions. Those assumptions can be grouped in three broad categories: the nature of whom the United States might need to fight and how that foe might prosecute an attack; which U.S. forces will be sent to the conflict and whether they would be ready to deploy; and whether military and commercial planes and ships will be available and operate as expected. So much uncertainty surrounds each of those issues that there is room for debate over almost any assumption that planner's make.

Probably no mobility analysis can definitely settle how much lift is enough and what combination of mobility forces best suits the needs of the United States. Ultimately, that is a subjective judgment in which decision makers must balance the cost of investing in mobility forces against the capabilities that those forces provide.

Mobility planners, less directly exposed to risk, tend to use fairly optimistic assumptions about what the United States could deliver early in a conflict. In the MRS BURU, for example, mobility planners assumed that reserve personnel would be called up quickly, that the weather would be clear, and that DoD would supplement its military airlift and sealift fleets quickly with commercial transportation. One assumption to which the MRS BURU is perhaps most sensitive is that decision makers receive unambiguous warning of an attack and then act quickly on that intelligence. Unfortunately, history is replete with examples of how leaders saw warnings of an impending attack and yet failed to act.

Besides uncertainty, another problem inherent in determining lift requirements is that planning for a major deployment involves two very different communities of military analysts: those who prepare for combat operations and those who plan to deliver the forces. Historically, war fighters and mobility planners have approached their task from widely different viewpoints. War fighters, such as regional commanders, face the consequences of risk most directly, so they make plans to deploy a large enough force to ensure dominance on the battlefield. Chapter III will examine the requirements in terms of current and projected airlift capabilities.

III. STRATEGIC AIRLIFT CAPABILITIES

A. FORCE RESTRUCTURING

U.S. planning for major theater conflict focuses on deterring and, if necessary, fighting and defeating aggression by potentially hostile regional powers, such as North Korea, Iran or Iraq. Such states are capable of fielding sizable military forces, which can cause serious imbalances in military power within regions important to the United States, with allied or friendly states often finding it difficult to match the power of a potentially aggressive neighbor. To deter aggression, prevent coercion of allied or friendly governments and, ultimately, defeat aggression should it occur, we must prepare our forces to confront this scale of threat, preferably in concert with our allies and friends, but unilaterally if necessary. To do this, we must have forces that can deploy quickly and supplement U.S. forward-based and forward-deployed forces, along with regional allies, in halting an invasion and defeating the aggressor, just as we demonstrated by our rapid response in October 1994 when Iraq threatened aggression against Kuwait. [Ref. 1]

How do planners decide what type and amount of strategic lift is best? The authors of the MRS BURU first identified how much force they believed the United States would need to halt enemy assaults on the Korean Peninsula and in the Persian Gulf region. Using computer simulations of combat, the Joint Chiefs of Staff and other DoD analysts tried to establish when certain units would need to arrive in order to limit the amount of risk faced by the forces that deployed earliest. Then, using simulations of cargo deliveries, they determined what combinations of mobility forces would allow DoD to meet those timelines.

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The role each type of strategic lift plays in a conflict is matched to its general characteristics. For example, because of its speed, airlift is used to deliver troops and equipment in the earliest stages of a military crisis. But airlift is many times more expensive than sealift, making it impractical for moving large numbers of forces or units with heavy tanks and armored vehicles. Sealift is much slower than airlift, but each large sealift ship can deliver the equivalent of more than 300 loads of a C-141, today's most common type of airlift plane. By prepositioning materiel, DoD can deploy large numbers of heavy forces much more quickly than with sealift and much more cheaply than with airlift. However, planners must select sites for prepositioned equipment carefully and recognize that political and diplomatic factors can limit how DoD uses that equipment.

Since DoD bases its numerical requirements for strategic mobility on its plans to fight major conflicts, it is important to understand how military officials believe those conflicts will take place. [Ref. 9]

B. PLANNING FOCUS

DoD analyses depict three phases of a large-scale conflict. During the halting phase, U.S. and allied forces would deploy to blunt an initial assault by an aggressor, minimize the amount of territory the invader takes over, and defend sites that are important for continuing military operations, such as ports, airfields, and supply centers. If the United States had to operate with little warning and an enemy's attack proceeded swiftly, airlift and prepositioning might be the only means of delivering forces during the halting phase. Under DoD's assumptions about conflicts in the Korean Peninsula or the Persian Gulf region, the first U.S. heavy ground forces would have to arrive within two to three weeks to halt an initial assault. Given the distances involved, that requirement for early combat units would place the greatest demand on U.S. mobility forces. [Ref. 5]

Once an aggressor had been stopped, the United States would focus its efforts on deploying additional combat forces and logistical support to the region. During that buildup phase, U.S. troops would try to reduce the enemy's military capabilities through sustained attacks. After enough forces had been deployed to the region, the United States and its allies would launch a counterattack, a large-scale offensive using air and land forces to push back the enemy and regain lost territory.

Ideally, civilian and military leaders would receive early, unambiguous warning of an impending enemy assault and would take a few measured steps to deter it. In military parlance, those steps are called flexible deterrent options--measures aimed at deterring enemy advances or aiding military deliveries that can be taken before the official decision to deploy forces en masse and can be revised quickly if the situation changes.

Such measures might include sending an aircraft carrier, a Marine expeditionary unit, or a squadron of fighter aircraft to the region or taking steps to prepare equipment at prepositioning sites. If an enemy attack occurred quickly and with little warning, however, airlift would be the only way to move equipment and supplies to the region

until the closest prepositioned equipment arrived. Units that would have priority for early airlift missions might include equipment to provide air defenses, transportation units that operate ports and airfields, light Army units, supplies to set up bases for air forces, initial squadrons of fighters and bombers, and some special-operations forces.

But there is a limit to what airlift can do. Although it can deliver light Army units quickly, the same is not true for units with more than a handful of tanks, since even the largest military cargo planes can carry only one or two of those vehicles at a time. Thus, DoD cannot rely on airlift to complete deliveries of heavy Army units within the halting phase of a conflict. For that reason, military planners have begun prepositioning equipment for Army brigades with tanks and heavy vehicles in or closer to regions where they believe conflict is most likely.

Not all equipment can be prepositioned. Military logisticians do not plan to preposition helicopters, radars, radios, or certain missiles because they are too few in number or too difficult to maintain. Thus, although prepositioning reduces DoD's need to transport some cargo by air, airlift would still deliver the remaining equipment and the troops who operate it (so-called fly-in echelons). If DoD plans to deploy a large number of heavy forces quickly in a conflict, the size of those fly-in echelons could be substantial, driving up requirements for early airlift missions.

After halting the attack, military commanders would send follow-on Army and Marine units and supplies to sustain the operation, with most arriving by sealift from the United States. Other supplies and equipment prepositioned on board ships would also steam to the region, including units to develop more extensive logistical supply lines. Airlift would transport equipment for aircraft squadrons, lighter ground forces, and key units such as corps-level artillery. Those deliveries would continue until military leaders believed they had enough forces and logistical support to launch a counterattack.

US forces will transition to fighting major theater wars from a posture of global engagement with substantial levels of peacetime engagement overseas as well as multiple concurrent Smaller Scale Contingency (SSC) operations. In the event of one major theater war, the United States would need to be extremely selective in making any

additional commitments to either engagement activities or SSC operations. The United States would likely also choose to begin disengaging from those activities and operations not deemed to involve vital US interests in order to better posture its forces to deter the possible outbreak of a second war. In the event of two such conflicts, US forces would be withdrawn from peacetime engagement activities and SSC operations as quickly as possible to be readied for war. The risks associated with disengaging from a range of peacetime activities and operations in order to deploy the appropriate forces to the conflicts could be mitigated, at least in part, by replacing withdrawing forces with an increased commitment of reserve component forces, coalition or allied forces, host nation capabilities, contractor support, or some combination thereof. [Ref 3]

The principal requirement is to mount an initial defense while rapidly deploying large US reinforcements from CONUS. The principal risk is losing some territory in the initial stages that might be hard to regain. Although US and allied forces would almost certainly win both wars, it might require a costly struggle. In all likelihood, only one war would erupt at any single moment, but the United States would withhold sufficient forces to deter a second war, and to win should it occur. The United States would probably deploy only about half its available combat posture to each theater.

Moreover, the factors that entered into DoD's numerical requirements for mobility forces are numerous and complicated. For those reasons, this study reviews the Administration's investment blueprint for the three types of mobility forces, addresses how military planners developed that plan, and evaluates several alternatives for modernizing strategic mobility.

C. CAPABILITIES

The MRS BURU recommended that DoD procure enough airlift planes to provide between 49.4 and 51.8 million ton-miles per day of theoretical airlift capacity. Rather than specifying a single requirement, the study set that range depending on how much more equipment military planners are able to preposition. If defense officials can add 280,000 square feet to prepositioned stocks, 49.4 MTM/D might provide enough capability to complete deliveries for the halting phases of two major conflicts with an acceptable level of risk. However, if DoD cannot preposition more forces or if the Army's

afloat prepositioning is not held in reserve for a conflict in the Persian Gulf, the study's authors believe more airlift is advisable. [Ref. 4:p. 4]

Successful U.S. power projection lies in our ability to field a modern strategic-airlift fleet, sufficient in both numbers and capability. This fleet must have adequate capacity, range, and versatility to meet the broad spectrum of military requirements. The core airlift problem becomes the C-141 as it retires and is replaced by the C-17. How do we meet the requirements driven by a near-simultaneous two MRC scenario? What number of C-17s is sufficient and what should the force mixture be to meet necessary airlift requirements?

Military planners divide airlift loads into three sizes: bulk loads that fit on a standard pallet, oversize loads that are larger than bulk loads but will fit in a C-141, and outsize loads that can fit only in a C-5 or C-17. Since the military uses many heavy vehicles and awkwardly shaped pieces of equipment, having transport planes that can accommodate that cargo is important.

The mix of equipment DoD would airlift to a major regional contingency today differs from what it planned to send for a conflict with the Soviet Union. According to a 1981 study of mobility requirements, 27 percent (by weight) of the equipment that DoD planned to send to a NATO/Warsaw Pact conflict within the first two weeks was outsize. By comparison, DoD's more recent simulations of deployments to Korea and the Persian Gulf region suggest that 15 percent to 18 percent of airlift deliveries over a similar period would be outsize. Official data for the first two weeks of Operation Desert Shield are unavailable, but during the first month of deployments, approximately 10 percent (by weight) of the cargo loads were outsize and half were bulk. [Ref. 5]

The decline in the relative need to carry outsize cargo is an important issue in deciding how many military planes like the C-17 are necessary. One advantage of C-17s and C-5s over civil-style planes is their ability to carry such cargo. However, if a large proportion of the equipment that DoD plans to send can fit on modified civil-style planes, DoD might need fewer C-17s.

The Clinton administration recommended acquiring 120 C-17s for strategic airlift, then increased the number to 134 in 2001. Cost and capabilities were compared across the C-17, the C-5D, and the C-33, a military version of the 747. In addition, in the study a Strategic Airlift Forces Mix Analysis was conducted to compare the relative performance of the fleet of C-17s against a mix of C-5D and C-33 fleets in conjunction with fewer C-17s. The study determined that certain combinations of C-17s and a mix of other airlift fleets could transport almost as much cargo to major regional conflicts as a fleet of 120 C-17s. However, the study also determined that although some mixed fleet combinations were less expensive, the study favored the C-17. The mixed fleet could not transport as much outsized cargo as the fleet of C-17s. Also, additional aircraft loaders would be required for the C-33 that could reach the height of the 747's cargo floor. [Ref. 5]

The cost of airlift options centered on the number of C-17s in a given fleet, which demonstrated correlation between an increase in MTM/D with the increase in the number of C-17s. The MRS BURU seemingly proceeded along the assumption that more airlift available to transport military forces translated into reduced risk. The results recommended modernizing mobility air forces with the C-17. The option recommended by the Clinton's administration was to acquire the smallest possible number of C-17s.

The MRS BURU recommended acquiring enough air lifters to transport between 49.4 and 51.8 MTM/D. The exact amount of MTM/D depends on the amount of prepositioned equipment. If USTRANSCOM can preposition enough equipment, 49.4 MTM/D would suffice to airlift the remaining cargo required for the halt phases of two major theater wars with an acceptable risk. According to the MRS BURU, acquiring 120 C-17s, plus the additional 14 that have been requested, would provide USTRANSCOM with 49.4 MTM/D of airlift capability. However, achieving any higher levels of airlift would require more C-17s or airlift capability. Based on the Army's requirements and assuming they prepositioned material; USTRANSCOM would increase the requirement to 49.7 MTM/D, with 23.2 MTM/D being produced from CRAF. [Ref. 8]

D. AIRLIFT CARGO CLASSIFICATION

AMC measures airlift capacity as MTM/D, which has allowed for a quick comparison. How does AMC determine MTM/D? They use a mathematical product of four factors: objective utilization rate, blockspeed, payload and productivity. The first factor, the objective utilization rate, is the average flight hours per day flown by aircraft in primary aircraft authorization (PAA) in service assigned to flying squadrons. The second factor, blockspeed, is the average ground speed in nautical miles (NM) per hour from takeoff to a block distance of 2,500 NM. The third factor, payload, is based on the average payload per aircraft as experienced in Operation Desert Shield and Desert Storm. The fourth factor, productivity, takes into account the aircraft returning from its offloading location to its next onloading location, which varies depending on the distances to these locations. The most important factors in understanding the limits of airlift capability are aircraft objective utilization rates and cargo classifications.

AMC employs three size classifications for loads; the choice of airframes available to transport classifications of cargo decreases as the size increases. The first classification, bulk cargo, is general cargo loaded on a standard pallet size (108 inches by 8 inches) or containers. A number of different airframes, including both military and commercial aircraft, commonly transport bulk cargo. The second classification, oversized cargo, is larger than bulk but less than outsize cargo. Two criteria define oversized cargo: palletized with an extended height of 96 inches or cargo with maximum dimensions of 105 inches in height, 109 inches in length and 117 inches in width. [Ref. 8] Currently, the only aircraft capable of carrying oversize cargo are the C-5, C-17, C-141, KC-10 and C-130. The third classification, outsize cargo, exceeds the dimensions of oversized cargo and requires either the C-5 or C-17 for transportation. Because of AMC's restriction on carrying the larger cargo classifications, the aircraft play an essential role in determining whether mobility objectives are met. [Ref. 8:p. 45]

Comparing the required MTM/D from the MRS BURU study and the actual MTM/D available from existing airframe platforms, there is a 5.8 MTM/D shortfall. This shortfall was made up of the following classifications: 33 percent outsize and 67 percent

oversize (fig 1). The short falls occurred because of the restricted cargo capabilities of the airframes at AMC's disposal and limited number of airframes capable of transporting outsize and oversize cargo. The airlift fleet has been divided into three categories. The first category includes both the C-17 and C-5 because they are capable of carrying bulk, outsize and oversize cargo. The second category includes both C-141 and KC-10 because they are capable of carrying bulk and oversize cargo. The third category includes commercial aircraft because they can only carry bulk cargo due to their low wings, high bodies and small doors. [Ref. 8:p. 46]

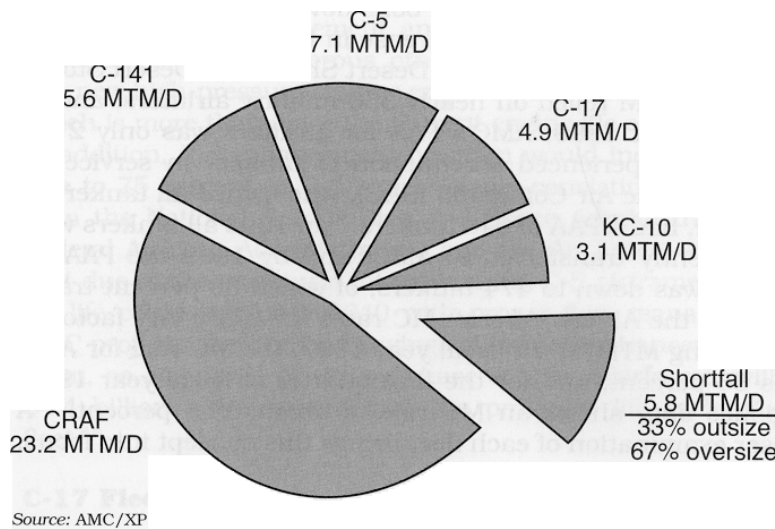


Figure 2. 49.7 Million Ton Miles Per Day.

E. MOBILITY AIRCRAFTS

Today's airlift fleet is made up of both planes that are dedicated solely to military missions and commercial aircraft that are part of the Civil Reserve Air Fleet (CRAF). If mobilized fully, the combined fleet would have a total theoretical airlift capacity of almost 50 million ton-miles per day. Nearly two-thirds of that amount comes from the military's own planes, with the rest contributed by civil carriers (see Figure 2).

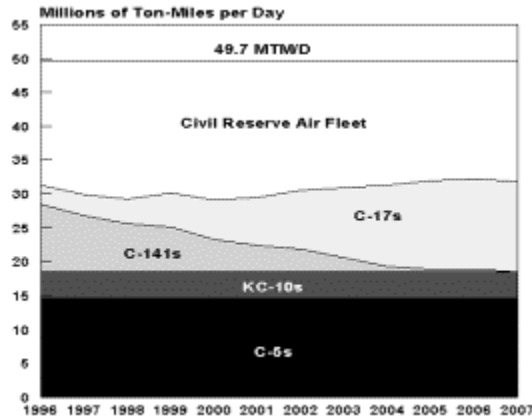


Figure 3. Theoretical Capacity of the Strategic Airlift Fleet Under the Administration's Plan, 1996-2007.

SOURCE: Congressional Budget Office based on Department of the Air Force, *1997 Air Mobility Master Plan* (Scott Air Force Base, Ill.: Air Mobility Command, October 11, 1996).

NOTE: Theoretical capacity is based on standard planning factors of the Air Force's Air Mobility Command. Based on a 1995 study of mobility needs and later analysis, the Department of Defense set a requirement of 49.7 million ton-miles per day (MTM/D) for theoretical capacity. To reach that level, the Air Force plans to supplement military planes with Civil Reserve Air Fleet capacity, which would amount to 20.5 MTM/D or less over the 1996-2007 period.

The C-141 fleet is the backbone of strategic airlift, yet it only contributes 5.6 MTM/D of the MRS BURU objective of 49.7 MTM/D. A fleet of 266 C-141 airlifters transported cargo during Operation Desert Shield and Desert Storm. The C-141 can transport 13 pallets a distance of 3,130 NM; and when aurally refueled it can fly anywhere in the world. Unfortunately, the C-141 has reached the end of service life; the fleet's retirement has begun and is scheduled for completion by 2006. [Ref. 1]

In a fully loaded configuration, the C-5 can transport 36 pallets and 73 passengers but requires aerial refueling to go beyond its fully loaded range of only 830 NM. However, with aerial refueling the C-5 can transport 13.2 MTM/D at the required 75 percent MC rates. However, the C-5 has actually averaged 7.07 MTM/D. Nearly 50 percent of the MTM/D shortfall, 2.7 MTM/D, resulted from the C-5s poor 59.4% MC rate. To help improve the C-5's performance, a Reliability Enhancement and Reengineering Program has been proposed. This program includes engine replacement. The new high turbine engines will work to 2,500 hours, which is twice the current engine

life of 1,200 hours. The enhancement program would increase the MC rate to 75 percent. [Ref. 8:p. 49]

The growing C-17 fleet will become the new backbone of airlift for AMC. The C-17 contributes 4.9 MTM/D to the total airlift capability. The C-17 has a 90 percent MC rate, with the capacity for 18 pallets or 102 passengers that will eventually provide approximately 16.5 MTM/D once all 134 requested C-17s are in service. As additional C-17s enter service in PAA billets among different squadrons, the outsized and oversized cargo shortfalls should subside. The C-17 has range limitations because development was a compromise. Thus, the C-17 has a short range for a strategic airlifter, which makes it very tanker intensive when fully loaded. To resolve the situation, extended range tanks have been proposed that would provide an additional 67,000 pounds of fuel in an added center-wing fuel tank. This new tank will add range to the C-17, which turn will reduce the C-17's dependency on tanker support or en route refueling stops. Another limitation is its inability to perform continuous direct delivery on a on a dirt runway. C-17s can direct deliver to a concrete runway on a continuous basis, but can deliver cargo on a dirt runway only once, maybe twice, because of the physical properties of the dirt. [Ref. 7] After the first landing, the aircraft's landing wheels cut ruts into the airstrip's dirt surface. The next aircraft landing cuts more ruts into the surface and so on until the airstrip is finally too torn up for landings. However, the C-17 can provide continuous flow using concrete-capped runways, which the Army Corps of Engineers can build within days at little cost. [Ref. 9]

The C-130 is AMC's core intratheater airlifter and compromises the Air Force's most varied fleet, with 21 different models and variants. The C-130 lacks interoperability within the fleet. For example, a crewmember that flies a C-130E cannot fly a C-130H3 because they are different aircraft. Sixty-three percent of the fleet is in the ANG and the AFRES. When a mix of active duty, Guard and Reserve forces support an operation, they form rainbow units at their deployed location, which results in manning and scheduling problems. Difference in equipment types causes crew qualifications differences that create a situation where C-130 crews are not interchangeable. These differences influence force operational effectiveness, which constrains the theater

commander's operation. Furthermore, each type of aircraft requires unique maintenance; unique mobility readiness spares package kit construction, and unique support equipment. The C-130 fleet is also an older fleet that requires upgrading. Ninety-three percent of the active duty aircrafts were built before 1978, 69 percent of the ANG aircraft were built after 1978, and 74 percent of the AFRES aircraft were built after 1982. Support for this aging fleet is increasing at 17 percent annually. In addition, mandated navigation and safety requirements drive the need to update avionics. [Ref. 8:p. 49]

The KC-10 is AMC's newest fleet of aircraft other than the C-17; the average age of the fleet is 16 years. The KC-10 is a modified DC-10 commercial aircraft, which can carry a maximum cargo weight of 55 tons on 27 pallets; its maximum load-carrying capability is 170 tons, which could be all fuel or fuel and cargo combined. As is the case with commercial aircraft, the KC-10 requires special loading equipment to lift cargo high enough to reach the aircraft's floor. Out of 54 KC-10 aircraft, AMC plans to augment its airlift fleet with an additional 37 during a single theater war, contributing 3.1 MTM/D to the total airlift capacity. Thus, only 17 KC-10s will be available as tankers during a major theater war, where operations tempo would dictate a need for more tankers.

The KC-135's primary mission during the Cold War was aerial refueling for SAC's armada of nuclear bombers, and it is still the backbone of aerial refueling. The KC-135 requires upgrades to meet mandated requirements in the aerospace environment. The avionic replacement program currently under way to achieve this is called PACER CRAG, which performs a number avionic upgrades to the aircraft. Another problem that has to be addressed is the insufficient crew ratio that has occurred in every operation from desert Shield to Allied Force. During Desert Shield and Desert Storm, USCENTCOM required a KC-135 crew ratio of 2:0, but the manning level set at 1.27:0 coupled with the high number of tankers required in theater and for air bridge support, this created an impossible situation. The KC-135 is one of the Air Force's oldest in-service aircraft, with an average fleet age of 39 years; it has been the backbone of aerial refueling for 45 years. It has been projected to retire beginning in 2013 and continuing through 2040. The MRS-05 studied aerial refueling alternatives to ensure actions were being reviewed before KC-135 retirement. [Ref. 9]

CRAF is a voluntary partnership between DoD and commercial air carriers designed to provide additional passenger and cargo planes and areomedical evacuation services to the military during times of crisis. Both cargo and passenger air carriers participate in one of three stages of the program, which reflect the priority with which planes might be called into service. Planes in Stage I would be called into service.

If a national emergency occurred today, commercial passenger planes would carry the vast majority of all military personnel who would be deployed to a major conflict. If fully mobilized, cargo carriers who participate in the program would contribute up to 27.8 MTM/D. However, participation in CRAF has fluctuated over time, so the Air Force only counts on about 20.5 MTM/D of cargo capacity from CRAF in its long-term planning. [Ref. 1]

F. MISSION REQUIREMENTS FOR STRATEGIC AIRLIFT

DoD officials base their numerical requirements for strategic airlift planes on two types of capabilities: the ability to deploy cargo, both during peacetime and in a major regional conflict; and the ability to perform special military missions, such as air-dropping forces after traveling long distances. Although civil-style planes can help meet the first need, the Administration contends that DoD requires large numbers of military aircraft for the second.

1. Major Conflict Operations

Mobility air forces deploy fighters to locations in-theater. Tankers move the fighters from CONUS to the theater of operations, where the fighters arrive ready to perform their missions. While working in the theater, fighters also rely on tankers to sustain them with fuel while airborne so that they can continually engage any airborne adversary without flying back to their base of operations to refuel their aircraft.

Sustaining combat air forces with materials and equipment once they are deployed in-theater requires ALOCs. Strategic airlifters require aerial refueling because they transit from the CONUS to operations in different theaters around the globe. Strategic airlifters transport cargo to aerial ports where air mobility support units transfer the cargo from the strategic airlifters to tactical airlifters. The tactical airlifters, in turn,

transport the cargo to combat forces at their crease with the Air Force's objective for achieving agile logistic support and the focused logistics concept identified.

2. Cargo Support for Other Operations

Because of the amount of equipment and supplies needed to fight two major regional contingencies, that planning scenario has driven DoD's assessment of its overall requirements for airlift, sealift, and prepositioning. But lesser regional contingencies may pose different problems for strategic lift. For example, the United States may need to deploy into places that are landlocked or far from ports, which would call for more airlift planes or greater use of ground transportation. And unlike Korea or the Persian Gulf region, which have modern airfields and ports, some areas lack long runways, deep ports, and equipment to unload planes and ships. Planning for those sorts of situations can raise DoD's requirements for planes and ships that have unique military features. Most recently, defense officials looked at examples of smaller operations to decide how many C-17s DoD would need to conduct such missions quickly. Thus, Congress may want to consider whether alternative investments in mobility forces include enough C-17s to deliver cargo to smaller operations under timelines laid out by DoD. But, as discussed earlier, the exact nature of future missions is highly uncertain. There is also room for debate about whether DoD must precisely meet the timelines set by military planners or whether policymakers are willing to accept a somewhat slower (and thus riskier) deployment. [Ref. 10]

A 1995 DoD analysis concluded that 40 C-17s could deliver cargo to any of three representative cases of smaller operations, involving Peacekeeping Missions, Humanitarian Assistance, and Evacuations of Noncombatants, with little risk of an extensive delay. DoD's analysis did not evaluate how many C-17s the United States would need if it became involved in several cases simultaneously. Furthermore, the United States may need to deploy larger numbers of troops to enforce peace between rivals, such as in the current U.S. operations in Bosnia. That type of operation would be smaller than a major regional conflict, but would probably involve more troops, heavier equipment, and tighter schedules than, say, a peacekeeping deployment. Thus, peace enforcement missions could place greater demands on airlift and raise requirements for

military planes such as the C-17. In a recent analysis of peace enforcement missions, DoD planners found that an airlift fleet between 72 and 86 C-17s could deploy U.S. forces within a time frame that they characterized as having moderate risk. If the Congress chose to include more C-17s in its mobility purchases, that level of risk might fall because the United States could probably conduct the deployment more quickly. Alternatively, DoD could buy fewer than 72 C-17s and accept somewhat slower airlift deliveries to such a mission. [Ref. 2]

3. Special Airlift Missions

Long-Range Airdrops of Large Forces are another requirement; the Army must be prepared to deploy brigade-size forces anywhere in the world within a short time frame. To that end, military planners must prepare to air-drop a "medium-force package" consisting of more than 2,500 troops and some of their equipment that have traveled intercontinental distances. (After the airdrop, cargo planes would deliver additional equipment to reinforce those units from airfields that the paratroopers had seized.) Defense officials believe that once the C-141 is retired from service, DoD will need at least 100 C-17s in its inventory to conduct such a large airdrop at a moderate level of risk. With a smaller number of planes, the United States could not insert its forces as quickly, and thus such a mission would be riskier. Alternatively, defense officials contend a fleet with 120 C-17s would ensure that DoD could deliver brigade-size forces within the timelines laid out by military planners. Army officials believe that DoD would need at least 120 C-17s for that mission.

Intratheater deliveries require additional assets that were not considered until MRS-05. Rather than devoting all of DoD's C-17s to strategic airlift, regional commanders would like to devote one or two squadrons to moving key pieces of equipment within a theater of operations. A 1995 DoD analysis concluded that the Air Force could conduct a strategic airlift deployment to DoD's major planning scenarios with mixtures of 86 to 100 C-17s, when combined with additional planes like the C-33. If military commanders chose to use some C-17s for intratheater deliveries, however, DoD would need to buy more of those aircraft. Because of this analysis, the 120 C-17 requirement was increased to 134. With fewer planes; DoD might not have enough to

devote to intratheater deliveries without significantly slowing the pace of deliveries from the United States. Alternatively, military planners would have to rely on trains and trucks to move outsize cargo. [Ref. 8:p. 62]

Direct Deliveries are even more critical, because the C-17 can carry outsize cargo and land at short, ill-equipped airfields. Military planners who prepare for combat might prefer that the Air Force deliver cargo directly from the United States close to a battlefield. Congress may want to consider whether using some C-17s in that way would significantly slow down deployments from the United States. According to DoD's analysis, airlift fleets with as few as 72 C-17s, when combined with additional C-33s, would allow the United States to conduct some direct deliveries but still keep an airlift deployment to a major regional conflict going at a pace associated with moderate risk. Fewer C-17s (or fleets with 72 C-17s but no C-33s) would slow that pace and, in the opinion of defense officials, unacceptably raise the risk that DoD could not complete its deliveries quickly enough. Alternatively, DoD could continue to conduct its airlift deployments the way it has in the past: delivering equipment to larger bases farther away from combat and then using trucks, railways, and smaller planes to move the equipment forward. [Ref. 8:p. 63]

G. OPTIONS FOR MODERNIZING TO SUPPORT STRATEGIC LIFT

The authors of the MRS BURU evaluated the military benefits of delivering combat forces more quickly by judging whether earlier arrivals would reduce the risk facing U.S. forces. But the uncertainties in analyzing mobility requirements are enormous-- so large that some mobility experts believe that analysis alone cannot answer how much lift is enough. The Department of Defense's requirements for mobility forces are open to question because they hinge on a large number of assumptions about how major deployments will take place. First, there is the nature of future conflicts: which aggressors might the United States face? How would they prosecute an attack? How much warning might leaders have? Will the United States have support from host nations or coalition partners? Second, there is uncertainty about which U.S. forces would be sent to the conflict, and whether they are adequately trained and ready to deploy. Finally, there are uncertainties about whether military and commercial transportation would be

available when needed and would perform as expected. These uncertainties are so fundamental that there will always be room for debate over how much lift is enough.

Despite the uncertainties, of course, defense officials must still decide how to allocate resources for lift. Because the future is unclear, military planners would probably prefer a larger number of mobility forces to handle any sort of contingency. But acquiring enough mobility forces to address all uncertainties would almost certainly be unaffordable.

To examine the costs and capabilities of other investment strategies, CBO developed five alternatives to the Administration's plan for strategic mobility. Each was designed to meet the needs associated with DoD's current planning scenario: fighting two nearly simultaneous major regional contingencies. Most of the alternatives would cost significantly less than the Administration's plan. Thus, they could free up resources for different types of defense spending, for deficit reduction, or for other federal priorities.

The five alternatives emphasize different modes of lift (see Table 1). Options I and II expand pre-positioning beyond what the Administration envisions (afloat and on land, respectively), in exchange for fewer C-17s for airlift. Options III and IV focus on airlift. Option III uses a different mix of planes than the Administration's plan: fewer C-17s and more commercial wide-body jets. Option IV adds 20 C-17s to the Administration's planned airlift fleet. Option V counts on the use of LMSR vice the C-17, thereby reducing the requirements for C-17s. [Ref. 1:p. 60]

Option	Airlift	Land-Based Prepositioning	Afloat Prepositioning	Surge Sealift
Administration's Plan	120 C-17s	Two heavy-brigade sets in the Persian Gulf, one in South Korea	One heavy-brigade set and support units on board eight LMSRs	11 LMSRs
I	48 fewer C-17s a	Same as Administration's plan	One more LMSR	Same as Administration's plan
II	48 fewer C-17s a	Adds 240,000 square feet of prepositioning in both the Persian Gulf and South Korea	Same as Administration's plan	Same as Administration's plan
III	48 fewer C-17s, a adds 30 C-33s b	Same as Administration's plan	Same as Administration's plan	Same as Administration's plan
IV	20 more C-17s c	Same as Administration's plan	One fewer LMSR	Same as Administration's plan
V	48 fewer C-17s a	Same as Administration's plan	Same as Administration's plan	One more LMSR

Table 1. Five Alternatives for Modernizing Strategic Mobility.

SOURCE: Congressional Budget Office.

NOTE: LMSR = large, medium-speed roll-on/roll-off ship.

a. A total of 72 C-17s, or 61 primary aircraft authorized.

b. A total of 30 C-33s, or 27 primary aircraft authorized.

c. A total of 140 C-17s, or 119 primary aircraft authorized.

1. Option I

Under the first alternative, DoD would purchase a total of 72 C-17s rather than 120. In place of airlift, Option I would substitute one additional LMSR that DoD would use to keep a larger amount of equipment prepositioned afloat.

The Army already plans to preposition much of its heaviest equipment, but it may be able to do more. For example, at least half of the weight associated with Army aviation units comes from trucks, trailers, and other vehicles that could be stored on an

LMSR. Similarly, the Air Force deploys most of its cargo by airlift, including heavy equipment for engineering units that could be prepositioned. For Option I, CBO identified nearly 260,000 square feet (or 11,400 tons) of equipment that DoD could preposition on board an additional LMSR--or roughly 14 percent to 19 percent of the total amount that would otherwise be airlifted during the first two to three weeks of a major conflict. CBO chose units that are likely to have high priority for early delivery during a major conflict to ensure that prepositioning the equipment would offset airlift requirements rather than add to them. [Ref. 1:p. 62]

Under Option I, the Navy and the Army would face higher costs associated with buying one additional ship and another set of equipment. CBO also assumed that the average cost of purchasing C-17s would be higher if the Air Force bought just 72 rather than 120. Nevertheless, CBO estimates that Option I would cost \$18.2 billion less than the Administration's plan over the 1998-2020 period. More than \$7 billion of those savings would accrue by 2002 (see Summary Table 2).

The Army's current plans involve placing equipment for one heavy brigade, its support units, and theater- and corps-level equipment on board eight LMSRs. Those plans by no means exhaust the Army's possibilities for prepositioning. For instance, helicopters are not suitable for storing on ships because performing routine maintenance on them would be difficult. But at least half of the weight of a heavy division's aviation units comes from trucks, trailers, and other vehicles that could be placed on an LMSR. Likewise, a few critical units that would most likely deploy during the halting phase of a major conflict--such as air-defense and artillery units--could be prepositioned.

Other military services may be able to expand their prepositioning as well. The Air Force already prepositions a considerable amount of equipment on land, so it can quickly establish air bases in remote or undeveloped regions. Yet other units might also be reasonable candidates. For example, Air Force engineering units perform jobs that aid the troop deployment, such as creating and augmenting airfields or, as in Bosnia, building housing. Because of their numerous trucks, bulldozers, forklifts, cranes, and the like, those units weigh a considerable amount, but the Air Force plans to deploy them by air. By purchasing additional sets of equipment for engineering units and prepositioning it

afloat or on land in the Persian Gulf and Korea, the Air Force might be able to conserve on demand for early airlift deliveries. [Ref. 1:p. 64]

	1998	1999	2000	2001	2002	Total, 1998- 2002	Total, 1998- 2002
C-17s							
Quantity	8	8	8	0	0	24	24
Acquisition costs ^a	2,473	2,643	2,290	520 ^b	438 ^b	8,364	8502
Operation and support costs ^c	376	503	597	684	772	2,932	17666
Large, Medium-Speed Roll-on/Roll-off Ships							
Quantity	2	2	0	0	0	4	4
Acquisition costs	663 ^d	558	0	0	0	1,220	1220
Operation and support costs for ships based in the United States	0	12	25	33	46	116	981
Costs of Prepositioning Afloat							
Operation and support costs	110	132	175	197	197	811	4562
Cost of buying extra equipment	0	248	124	0	0	372	372
Costs of Prepositioning in Korea and the Persian Gulf							
Acquisition costs	45	0	0	0	0	45	45
Operation and support and military construction costs	85	105	109	112	112	522	2707
Total Costs	3,750	4,201	3,320	1,547	1,565	14,383	36056
Savings from the Administration's Plan	76	217	1,019	2,937	2,886	7,134	18,183

Table 2. Total Costs Under Option I (In Millions of 1997 Dollars of Budget Authority).

SOURCE: Congressional Budget Office.

a. Assumes an annual-procurement strategy rather than a multiyear-procurement strategy.

b. Includes funding for support equipment, spare parts, and costs associated with shutting down the manufacturing line.

c. Includes operation and support costs for the first 48 C-17s. At a steady-state level, those 48 planes (41 primary aircraft authorized) would cost approximately \$533 million a year (in 1997 dollars) to operate and support.

d. Includes advance procurement funding for two ships in 1999.

2. Option II

CBO's second alternative is similar to Option I in that DoD would limit its C-17 purchase to 72 planes. Rather than expanding prepositioning on ships, however, Option II would preposition more equipment in warehouses erected both in South Korea and in the Persian Gulf region. The services would need to purchase two extra sets of equipment--

one for each location--so Option II would actually cost slightly more than Option I, even though DoD would not buy an additional LMSR. But DoD could tailor the prepositioned sets for the scenario at hand, including important equipment, such as that to support a Patriot air-defense artillery battalion, that DoD believes does not stand up well to prepositioning at sea. [Ref. 1]

Under Option II, DoD would purchase 24 additional C-17s over the next three years, for a total of 72 planes. Instead of buying another LMSR for prepositioning, however, DoD would build climate-controlled warehouses in both the Korean and Persian Gulf regions, and preposition nearly 240,000 square feet (or about 11,400 tons) of equipment at each site. As with Option I, CBO selected equipment for prepositioning that is likely to be of high priority in DoD's deployment schedule. That measure helps to ensure that the additional prepositioning offsets rather than adds to airlift requirements.

CBO estimates that the savings associated with a smaller airlift purchase would far outweigh the added costs of building warehouses, buying extra equipment, and guarding and maintaining it. Net of those costs, Option II would save \$16.8 billion compared with the Administration's plan over the 1998-2020 period, or \$6.4 billion through 2002. However, CBO estimates that the cost of building warehouses and buying additional equipment would push Option II's price tag about \$1.4 billion above Option I's through 2020. In all, CBO estimates that Option II would cost \$15.1 billion over the 1998-2002 period or about \$37.5 billion between 1998 and 2020 (see Table 3). [Ref 1]

In order not to underestimate the costs of buying additional equipment, CBO included purchases of some major weapon systems, including a Patriot missile battalion for each region. (Maintaining the Patriot's sensitive electronics on board ships is difficult, so that system was not included among the equipment purchased for Option I.) If DoD substituted other units for the more expensive Patriot battalion, Option II might cost \$460 million less over the 1998-2020 period. Given uncertainties about the type of equipment that DoD would need to purchase for those two alternatives, readers could consider their costs to be roughly comparable.

As with Option I, CBO assumed that the Air Force would procure the remaining 24 C-17s more slowly than current plans allow. That assumption leads to lower total acquisition costs in the near term (since DoD would buy fewer aircraft), but a higher average cost for each one. [Ref. 1]

	1998	1999	2000	2001	2002	Total, 1998- 2002	Total, 1998- 2020
C-17s							
Quantity	8	8	8	0	0	24	24
Acquisition costs ^a	2,473	2,643	2,290	520 ^b	438 ^b	8,364	8,502
Operation and support costs ^c	376	503	597	684	772	2,932	17,666
Large, Medium-Speed Roll-on/Roll-off Ships							
Quantity	2	1	0	0	0	3	3
Acquisition costs	628 ^d	282	0	0	0	909	909
Operation and support costs for ships based in the United States	0	12	25	37	46	120	985
Costs of Prepositioning Afloat (Operation and support)	110	132	175	175	175	768	4,101
Costs of Prepositioning in Korea and Persian Gulf							
Acquisition costs	245	0	803	401	0	1,449	1,449
Operation and support and military construction costs	85	105	109	112	170	580	3,857
Total Costs	3,915	3,677	3,999	1,930	1,600	15,121	37,470
Savings from the Administration's Plan	(89)	741	340	2,554	2,851	6,396	16,768

Table 3. Total Costs Under Option II (In Millions of 1997 Dollars of Budget Authority).

SOURCE: Congressional Budget Office.

a. Assumes an annual-procurement strategy rather than a multiyear-procurement strategy.

b. Includes funding for support equipment, spare parts, and costs associated with shutting down the manufacturing line.

c. Includes operation and support costs for the first 48 C-17s. At a steady-state level, those 48 planes (41 primary aircraft authorized) would cost approximately \$533 million a year (in 1997 dollars) to operate and supports

d. Includes advance procurement funding for two ships in 1999.

3. Option III

Under the third alternative, DoD would acquire the same theoretical airlift capacity that 120 C-17s provide but with a less expensive mixture of planes: instead of procuring a total of 120 C-17s, Option III would purchase 24 more C-17s (for a total of 72) plus 30 larger and less expensive commercial wide-body jets (CBO used estimates of the cost and capabilities of the C-33, a military version of the Boeing 747-400 freighter, for this analysis). Each C-33 can hold more cargo than a C-17, but the latter can carry a wider variety of military equipment because of the larger width and height of its doors and cargo hold. Nevertheless, this option would give DoD a comparable level of theoretical airlift capacity as the Administration's plan. (Theoretical airlift capacity measures the amount that all airlift planes in a fleet could carry when fully mobilized, using average measures of each plane's performance. Actual airlift deliveries tend to be lower than theoretical capacity.) [Ref. 1]

As with Options I and II, DoD would purchase its C-17s at a slower pace than under the Administration's budget proposal--a maximum of eight per year rather than 15. Thus, the average cost of each C-17 would be higher under these alternatives. Nevertheless, CBO estimates that total costs for Option III, including purchases of C-17s and commercial planes, would be about \$4.1 billion in 1998, or \$0.3 billion more than the Administration's plan in that year (see Table 4). CBO estimates that Option III would cost \$8.4 billion less than the Administration's plan over the 1998-2020 period--nearly \$4 billion less over the first five years. [Ref. 1]

	1998	1999	2000	2001	2002	Total, 1998- 2002	Total, 1998- 2020
C-17s							
Quantity	8	8	8	0	0	24	24
Acquisition costs ^a	2,473	2,643	2,290	520 ^b	438 ^b	8,364	8,502
Operation and support costs ^c	376	503	597	684	772	2,932	17,666
C-33s							
Quantity	1	1	6	6	6	20	30
Acquisition costs	429	180	1,025	1,040	1,152	3,827	5,959
Operation and support costs	0	0	0	5	48	53	4,932
Large, Medium-Speed Roll-on/Roll-off Ships							
Quantity	2	1	0	0	0	3	3
Acquisition costs	628 ^d	282	0	0	0	909	909
Operation and support costs for ships Based in the United States	0	12	25	37	46	120	985
Costs of Prepositioning Afloat (Operation and support)	110	132	175	175	175	768	4,101
Costs of Prepositioning in Korea and the Persian Gulf							
Acquisition costs	45	0	0	0	0	45	45
Operation and support and military construction costs	85	105	109	112	112	522	2,707
Total Costs	4,145	3,857	4,221	2,574	2,743	17,540	45,807
Savings from the Administration's Plan	(319)	561	118	1,910	1,708	3,977	8,432

Table 4. Total Costs Under Option III (In Millions of 1997 Dollars of Budget Authority).

SOURCE: Congressional Budget Office.

a. Assumes an annual-procurement strategy rather than a multiyear-procurement strategy.

b. Includes funding for support equipment, spare parts, and costs associated with shutting down the manufacturing line.

c. Includes operation and support costs for the first 48 C-17s. At a steady-state level, those 48 planes (41 primary aircraft authorized) would cost approximately \$533 million a year (in 1997 dollars) to operate and support.

d. Includes advance procurement funding for two ships in 1999.

4. Option IV

To demonstrate all of the trade-offs between prepositioning and airlift, Option IV is the reverse of Option I: DoD would rely more heavily on airlift to deliver cargo during the halting phase of two major regional contingencies. Specifically, Option IV would buy a total of 140 C-17s. That size fleet would give DoD about 7 percent more

theoretical airlift capacity from its own fleet than under the Administration's plan, providing the Air Force with the upper end of its desired range for theoretical airlift capacity--nearly 52 MTM/D by 2006. But the alternative would also scale back purchases of LMSRs by one, leaving seven rather than eight ships to house prepositioned Army stocks in the Indian Ocean. For that reason, Option IV can be thought of as the reverse of Option I, which would add an LMSR for afloat prepositioning and subtract C-17s. [Ref. 1]

CBO assumed that DoD would purchase C-17s at a maximum rate of 15 per year under a multiyear-procurement contract, as in the Administration's current plan. Under Option IV, DoD would buy its 20 additional planes in 2003 and 2004. Purchasing 20 more C-17s than the Administration's plan would lower the average procurement cost of each plane. But airlift is so much more expensive than other modes of lift; the cost of a larger number of C-17s would far surpass the savings associated with one fewer LMSR. CBO estimates that Option IV's price tag would be \$3.8 billion in 1998 and \$21.3 billion over the 1998-2002 period (see Table 5). CBO estimates that Option IV would cost roughly the same as the Administration's plan between 1998 and 2002, but \$6.3 billion more than the Administration's plan through 2020. [Ref. 1]

5. Option V

The fifth alternative would once again limit DoD's C-17 purchases to a total of 72, but it would buy an additional LMSR that DoD would use in the place of airlift to surge cargo from the United States during wartime. Compared with ships prepositioned in the Indian Ocean, surge sealift vessels would have a longer distance to travel, so Option V would not permit DoD to complete deliveries as quickly as Option I, whose forces are identical. But if DoD's assumptions about how much equipment it could deliver quickly by airlift and prepositioning are implausible, Option V may be more practical. [Ref. 1]

Option V is the least costly of the alternatives. CBO estimates that it would save \$18.9 billion compared with the Administration's plan over the 1998-2020 period and \$7.5 billion between 1998 and 2002. Through 2020, it would also cost \$746 million less than Option I (see Table 6). [Ref. 1]

	1998	1999	2000	2001	2002	Total, 1998- 2002	Total, 1998- 2020
C-17s							
Quantity	9	13	15	15	15	67	92
Acquisition costs	2,584	3,384	3,433	3,440	3,399	16,238	21,865
Operation and support costs ^a	376	503	597	725	886	3,086	30,662
Large, Medium-Speed Roll-on/Roll-off Ships							
Quantity	2	0	0	0	0	2	2
Acquisition costs	611	0	0	0	0	611	611
Operation and support costs for ships Based in the United States	0	12	25	41	46	124	989
Costs of Prepositioning Afloat (Operation and support)	110	132	154	154	154	702	3,619
Costs of Prepositioning in Korea and the Persian Gulf							
Acquisition costs	45	0	0	0	0	45	45
Operation and support and military construction costs	85	105	109	112	112	522	2,707
Total Costs	3,809	4,136	4,317	4,471	4,595	21,329	60,497
Savings from the Administration's Plan	17	282	22	13	(145)	189	(6,259)

Table 5. Total Costs Under Option IV (In Millions of 1997 Dollars of Budget Authority).

SOURCE: Congressional Budget Office.

a. Includes operation and support costs for the first 48 C-17s. At a steady-state level, those 48 planes (41 primary aircraft authorized) would cost approximately \$533 million a year (in 1997 dollars) to operate and support.

	1998	1999	2000	2001	2002	Total, 1998- 2002	Total, 1998- 2020
C-17s							
Quantity	8	8	8	0	0	24	24
Acquisition costs ^a	2,473	2,643	2,290	520 ^b	438 ^b	8,364	8,502
Operation and support costs ^c	376	503	597	684	772	2,932	17,666
Large, Medium-Speed Roll-on/Roll-off Ships							
Quantity	2	2	0	0	0	4	4
Acquisition costs	663 ^d	558	0	0	0	1,220	1,220
Operation and support costs for ships based in the United States	0	12	25	37	50	124	1,068
Costs of Prepositioning Afloat (Operation and support)	110	132	175	175	175	768	4,101
Costs of Prepositioning in Korea and the Persian Gulf							
Acquisition costs	45	0	0	0	0	45	45
Operation and support and military construction costs	85	105	109	112	112	522	2,707
Total Costs	3,750	3,953	3,196	1,529	1,547	13,975	35,310
Savings from the Administration's Plan	76	465	1,143	2,955	2,904	7,542	18,929

Table 6. Total Costs Under Option V (In Millions of 1997 Dollars of Budget Authority).

SOURCE: Congressional Budget Office.

a. Assumes an annual-procurement strategy rather than a multiyear-procurement strategy.

b. Includes funding for support equipment, spare parts, and costs associated with shutting down the manufacturing line.

c. Includes operation and support costs for the first 48 C-17s. At a steady-state level, those 48 planes (41 primary aircraft authorized) would cost approximately \$533 million a year (in 1997 dollars) to operate and support.

d. Includes advance procurement funding for two ships in 1999.

	Administra- tions Plan	Option				
		I	II	III	IV	V
Cumulative Costs (In billions of 1997 dollars)						
1998-2002						
Total	21.5	14.4	15.1	17.5	21.3	14.0
Savings from the Administration's plan	n.a.	7.1	6.4	4.0	0.2	7.5
1998-2020						
Total	54.2	36.1	37.5	45.8	60.5	35.3
Savings from the Administration's plan	n.a.	18.2	16.8	8.4	(6.3)	18.9
Cumulative Airlift Deliveries to the Persian Gulf Plus Sustainment to Korea (In thousands of tons) a						
By day 10	74.6	69.7	69.7	71.8	78.2	69.7
By day 15 (plus or minus incremental prepositioning) b	97.5	102.2	102.1	93.3	92.8	90.7
By day 20 (plus or minus incremental prepositioning) b	119.9	123.1	123.0	114.6	117.6	111.6
Difference from the Administration's plan	n.a.	3.1	3.1	(5.3)	(2.4)	(8.3)
Outsize Airlift Deliveries to Korea (In thousands of tons) c						
By day 10	13.8	12.8	12.8	13.6	15.9	12.8
By day 15	18.0	17.0	17.0	17.8	22.9	17.0
By day 20	22.0	20.8	20.8	21.8	27.8	20.8
Difference from the Administration's plan	n.a.	(1.2)	(1.2)	(0.3)	5.7	(1.2)
Flexibility to Handle Changes in Deployment Schedules	Very flexible	Less flexible	Least flexible	Very flexible	Most flexible	Flexible but slow
Vulnerability to Enemy Attack	Less vulnerable	More vulnerable	Most vulnerable	Less vulnerable	Least vulnerable	More vulnerable
Risk Associated with Cargo Deliveries to Smaller Operations d,e						
Peacekeeping missions, humanitarian assistance, and evacuations	Low	Low	Low	Low	Low	Low
Peace enforcement missions	Low	Moderate	Moderate	Moderate	Low	Moderate
Risk Associated with Special Airlift Missions d						
Strategic brigade airdropse	Low	High	High	High	Low	High
Intratheater unit moves	Low	High	High	High	Low	High
Direct delivery	Low	High	High	High	Low	High

Table 7. Comparison of the Costs and Capabilities of Alternatives for Modernizing Strategic Mobility.

SOURCE: Congressional Budget Office.

NOTE: n.a. = not applicable.

a. While deploying forces by air to the Persian Gulf, cargo planes would also continue airlift operations on a smaller scale to the Korean Peninsula. The values shown here include airlift deliveries to Korea that would occur at the same time as the deployment to a second conflict in the Persian Gulf. They include airlift deliveries for flexible deterrent options in the Persian Gulf region.

b. For two of the alternatives, CBO included deliveries of 11,400 tons of additional equipment prepositioned either afloat (Option I) or on land (Option II). For deliveries under Option IV, CBO subtracted 11,400 tons to reflect one fewer large, medium-speed roll-on/roll-off ship used for afloat prepositioning.

c. Includes deliveries for flexible deterrent options.

d. Risk in this case refers to risk of failing to complete the delivery mission in the required time.

e. CBO was unable to independently assess the risk associated with these missions. The levels shown are based on Defense Department analysis.

Each of CBO's five alternatives reflects a unique combination of costs and capabilities. How to balance the trade-offs between risk and cost depends on the likelihood that the United States will become involved in major or smaller regional conflicts, as well as whether U.S. forces will need to perform special airlift missions. Ultimately, those are subjective judgments that defense officials and the Congress must make.

Alternatives that include more prepositioned equipment--either on board ships (Option I) or in foreign countries (Option II)--would cost less than the Administration's plan. Based on CBO's estimates, those savings could be considerable: approximately \$18.2 billion or \$16.8 billion, respectively, over the 1998-2020 period. However, those alternatives would require DoD to accept some additional risks. For instance, military leaders would need to be sure which units they would dispatch first to major conflicts, since rearranging the priority for deploying units would be more difficult. Of course, redeploying prepositioned equipment to other regions, if needed, would also take time, although Option I would be more flexible in that regard than Option II. Finally, sending troops to meet up with prepositioned gear makes deployments more complicated; the services would need to conduct more exercises in which personnel practice unloading, distributing, and deploying prepositioned sets of equipment. [Ref. 1]

A key difference between Options I and II is that prepositioning equipment on an ally's territory can be more sensitive politically than storing it on board ships that steam through international waters or are based at a friendly port, such as Diego Garcia. Thus, one hurdle to carrying out Option II would be securing agreements with allied nations to host prepositioning sites. Although such agreements have not been difficult to obtain with South Korea, there have been more sensitivities in placing U.S. equipment in Saudi Arabia and other parts of the Persian Gulf region. Moreover, even if the United States obtained approval to expand prepositioning in a region, those political sensitivities might continue to limit how and when the equipment was used. [Ref. 1]

However, one benefit of prepositioning equipment on land rather than afloat is that it can be tailored to the scenario at hand. For example, prepositioning sites in the

Persian Gulf would most likely include larger numbers of heavy-equipment transports or desalination units than equipment sets in South Korea.

Alternatives that substitute more sealift ships for airlift--either as a platform on which to preposition equipment (Option I) or to surge cargo from the United States (Option V)--also introduce some risks. Since each LMSR carries such a large concentration of cargo, mines or attacks on harbors could cause greater delays in deliveries than if one or two airfields were closed. Deliveries might also be delayed if U.S. ships were unable to transit key choke points such as the Suez Canal or the Strait of Hormuz. [Ref. 1]

Yet despite those risks, LMSRs provide considerable delivery capacity at relatively low cost. For example, even if DoD purchased a total of 140 C-17s (as in Option IV), the addition of 20 planes beyond the Administration's planned level could not offset one fewer LMSR prepositioned in the Indian Ocean. Thus, according to CBO's estimates, Option IV could not deliver as much cargo to two major regional conflicts during the crucial halting phase. [Ref. 1]

Option III would give DoD some of the advantages of airlift, such as more flexibility to adjust deployment schedules to changing circumstances, at a savings of \$8.4 billion over the 1998-2020 periods. But like Options I, II, and V, Option III would not include enough C-17s to perform certain types of special airlift missions, such as strategic airdrops of brigades or intratheater cargo deliveries. [Ref. 1]

Although they cost the most, alternatives that include the largest numbers of C-17s (such as the Administration's plan and Option IV) have some distinct advantages. They would permit the Air Force to conduct a wider range of smaller deployments or special airlift missions with more confidence. And military commanders would have more flexibility to rearrange the order in which they deploy units to a major regional contingency. But whether those advantages are worth the considerable cost of the C-17 depends on whether decision makers believe that DoD is likely to need to perform those tasks or to require the flexibility of 120 C-17s in the years ahead.

Based on DoD's analysis, then, alternatives that include just 72 C-17s (Options I, II, III, and V) might not be adequate to conduct special missions like strategic brigade airdrops and intratheater deliveries. However, airlift is the most costly mode of lift, and the C-17, although a very capable plane, is also quite expensive. Thus, the Congress may want to balance the cost of larger numbers of C-17s against the likelihood that the United States will need to perform the types of special airlift missions for which they are necessary. [Ref. 1]

H. CONCLUSION

This chapter examined the force structure of the air mobility force and identified several challenges if it is to achieve the objectives set by the National Security Strategy. The current force structure falls short of the targeted strategic environment that it sought to fulfill. In addition, the current force structure is incongruent with the vast diversity of requirements in today's strategic environment, which range from coercive military operations to humanitarian operations.

The problem the air mobility force faces is not the capability of the new core airlifter, but instead the relatively small number of operational C-17s that replace the C-141s. Our inability to meet peak demands along the deployment timeline presents a significant deficiency in moving volume at crucial time in the contingency. The capability lines of today's fleet and the fleet of the future are linear because they represent the fixed number of airframes operating at the wartime surge rate.

Two points have to be addressed when logistical supply is not meeting the war fighter's demand in contingency operations. Our forces will suffer losses while they wait for the equipment and supplies they need to fight and win. Even more importantly, the war can be over with if we can't deploy to the theater quickly and ready to fight. Airlift provides the crucial, rapid response we require to position forces to fight. For each MTM/D we shortfall we compromise our ability to meet the requirements for our NSS; we place our people and the successful outcome of the contingency at risk. The next chapter will discuss how the Army plans to set its goals and transform to support deploying forces rapidly to regional conflict areas.

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IV. THE ARMY'S TRANSFORMATION CAMPAIGN

A. VISION

The spectrum of 21st century operations demands land forces in joint, multinational, and interagency formations for a variety of missions extending from humanitarian assistance and disaster relief to peacekeeping, peace enforcement, and winning major theater wars--our non-negotiable contract with the American people. In October 1999, senior Army leaders announced a new Vision to enable the Army to better meet these diverse, complex demands. The Vision's goal is to ensure that the Army fulfills its responsibilities in meeting the NMS. To do this, the Army must transform itself into a full spectrum force more capable of dominating at every point on the spectrum of operations. The Objective Force resulting from the Vision will meet the challenges of the 21st century by providing the Nation with an Army that is more responsive, deployable, agile, versatile, lethal, survivable, and sustainable. [Ref. 12]

These characteristics of the Objective Force are complementary features that together produce an overall capability greater than the individual capabilities they describe. The characteristics arise from the Vision's goal and the likely shape of the future international security environment. In turn, they provide the analytical foundation for developing the concepts, doctrine, and systems that will constitute the Objective Force.

The Objective Force must be responsive to allow the Army to meet frequent contingency requirements with any element of the force. To be responsive requires the ability to put forces where needed on the ground, supported by air and naval forces, to directly affect the outcome of the situation or crisis at hand within hours of a decision. The forces deployed must be prepared to accomplish their mission regardless of the environment, the nature or scope of the proposed operation, or other commitments. They should have a demonstrated capability to deter the prudent adversary, as well as to influence and shape the outcome of the crisis. If required, they should have the ability to employ force from low to high-intensity. Responsiveness applies to more than just

operational forces; the entire mobilization process must be responsive to ensure the entire force is available in a timely manner.

To achieve this responsiveness, Objective Force units must be deployable. These units must be capable of rapid strategic movement to create the opportunity to avert conflict through deterrence and confront potential adversaries before they can achieve their goals. The Objective Force requirement is to have a combat brigade on the ground within 96 hours after liftoff, a division within 120 hours, and five divisions within 30 days. Within a theater of operations, Army forces must be able to reposition rapidly to create and exploit advantage. The Army must reduce the size of its systems to attain the desired level of strategic and intra-theater deployability. [Ref. 13]

Because of the broad range of missions that will be assigned to U.S. forces, often in highly volatile situations, Army forces must be able to shift intensity of operations without augmentation, a break in contact, or additional training. Today's forces possess the agility to shift seamlessly from offensive to defensive to offensive operations on the battlefield. The Objective Force must replicate that same agility in a much broader, full spectrum context within entire theaters of operation. These forces will frequently be called upon to transition from non-combat disaster relief to low-intensity contingencies to high-intensity warfighting with little or no time to change mindset or organizational design. The ability to make these transitions in an agile manner without losing momentum is a function of our people. The Army will develop it through leadership and training. [Ref. 13]

Versatility is closely related to agility, but is a function of force organization and equipment. The elements of the Objective Force must be adaptive to changing situations and must have utility across the spectrum. These characteristics will allow the Army to respond when needed and rotate forces in and out to relieve OPTEMPO and PERSTEMPO. The frequency and duration of small-scale contingency (SSC) operations leave neither the time nor the forces for overly specialized units or extensive reorganization and preparation for specific missions. The Army cannot sustain the operational and personnel tempo of the broad range of crisis response SSC operations and sustained commitments with only part of its force. Therefore, the Army must have the

ability to commit all of the force in its turn, regardless of component, to meet operational demands, even if those demands are for distinct operations in different areas of the world. All Army forces must have the built-in organizational flexibility to respond.

An overwhelming ability to win through application of lethal force can frequently preclude conflict by making the adversary's potential losses disproportionate to his objectives. Lethality must be embedded in every force and unit. They must all have the ability to transition from peace to war and access joint capabilities easily without a break in momentum. Even in a seemingly benign environment, our forces cannot ignore the possibility of a chance encounter with hostile elements, whether because of a sudden, unforeseen change in the situation or from radical factions determined to undermine the peace. The consequences of the inability to apply appropriate lethal effects are not just unnecessary loss of life, but could include significant political and operational changes in the environment. Furthermore, lethality signals to our adversaries the potential consequences to them of their willingness to escalate the conflict.

As the forces continue to operate in harm's way, it is crucial to their confidence that we take all possible measures to protect the force and ensure its survival. Survivability also affects the perceptions of our adversaries about their ability to fight and win against U.S. forces. But the survivability of the Objective Force must extend beyond combat operations across the full spectrum of operations, and it must address current and emerging asymmetric capabilities. To meet these challenges, the Army must have modern equipment that incorporates new technologies to meet mission requirements, counter emerging threat capabilities, and reduce the risks of fratricide.

Our Army forces must retain the capability to continue operations longer than any adversary we confront. This is a critical aspect of equipment superiority. Sustainability is directly linked to responsiveness and deployability. Careful planning and discipline is essential to deploy only those forces and systems needed to ensure dominance at every point on the spectrum of operations. Sustainment requirements will be reduced, where possible, by minimizing forces deployed into the area of operations through split basing and the use of technology to provide reach-back capability. Host nation and allied support for our forces can also reduce sustainment requirements, but the Army must be able to

operate unilaterally if necessary. Consequently we must continue to find ways to exploit advanced technologies and reduce the logistics footprint and related costs of our support structure.

As it transforms itself into the Objective Force with the characteristics described above, the Army will remain a values-based force that derives its greatness from its people. The Army will continue to attract, train, motivate, and retain the most competent and dedicated people in the Nation to fuel our ability to be persuasive in peace and invincible in war. The Army will invest in training, educating, and equipping our soldiers while providing them and their families with the well being necessary to make the Army a rewarding and fulfilling profession. Providing our soldiers and leaders with a strong physical, mental, and moral foundation will enable them to act decisively while conducting full spectrum operations in the complex environments they will surely face. [Ref. 12]

B. THE ARMY'S TRANSFORMATION

At present, although the Army is capable of full spectrum dominance, its organization and force structure are not optimized for strategic responsiveness. Army options available to warfighting CINCs for joint contingency response are too limited. Army light forces can deploy quite rapidly—within a matter of days—but they lack the lethality, mobility, and staying power necessary to assure decisive action. On the other hand, Army mechanized forces possess substantial lethality and staying power, but they require too much time to deploy, given current joint capabilities for strategic lift, affording the adversary too much time to prepare for the arrival of US forces. Typically, each mission requires deploying an augmented corps- or division-level headquarters commanding a mission-tailored force. Experience indicates that it normally takes as much or more time to construct and deploy the headquarters element as it does to deploy the tactical formations. As a result, today's joint contingency responses typically follow a sequential deployment pattern that requires considerable time and effort to build up military power sufficient and flexible enough to deter aggression, contain the crisis, and/or shape the battlespace and achieve decision.[Ref. 13]

Today's Army—the Legacy Force—consists of both heavy and light forces. It contains strategically agile light forces that can deploy very rapidly but lack the necessary mobility, lethality and survivability to oppose the full range of potential enemy capabilities once deployed. Conversely, its heavy forces possess unmatched lethality, survivability, tactical mobility and endurance, but require too much and too many assets to deploy quickly given current joint capabilities for strategic lift.

Constraints on lift apportioned to ground forces introduce delays in the build-up of a synchronized joint force. These constraints often lead to the initial introduction of ground force packages that lack deterrent credibility because they are unable to immediately conduct multidimensional operations. Prepositioned war stocks reduce strategic lift requirements, but only in the specific regions where those stocks are stored or can be quickly inserted. Consequently, today's limited strategic lift capability causes U.S. military responses to follow predictably sequential deployment patterns to build sufficient military power to contain, shape and achieve decision. This reduces the deterrent effect of U.S. forces in regional conflicts. Transforming the Army into a lighter, more deployable force will partially address these issues, but must be complemented by a comprehensive program to improve joint strategic lift capabilities for both the Legacy Force and future forces.

C. OBJECTIVE FORCE DEVELOPMENT

The Objective Force will be designed to provide decisive combat power to dominant land operations in future joint contingencies. It will be a strategically responsive, general-purpose force that participates in all phases of the joint campaign, in all environments, weather, and terrain. The force will incorporate revolutionary change embodied in advanced C4ISR capabilities; Future Combat Systems (FCS); future reconnaissance, lift, and attack aircraft; and the products of the revolution in military logistics. Capabilities are derived from concepts in the force development process. The Army builds capabilities and forces around soldiers to fully exploit and sustain human dimensions of warfare rather than building platforms that are simply enabled by soldiers. Army forces do not fight platforms; they fight soldiers led by capable leaders, organized into effective units, and enabled by advanced capabilities to create overmatching combat

power. As the capabilities are derived, the Army will devote comprehensive efforts to insure that its soldiers are trained, educated and equipped to meet the requirements of future conflicts. [Ref. 13]

The degree to which the Objective Force fully embodies the characteristics outlined in the Army's Vision--responsive, deployable, agile, versatile, lethal, survivable and sustainable---will determine to a significant degree the overall capability of the force to carry out its core operational tasks within the joint campaign.

A responsive and deployable Objective Force empowers joint commanders with broader options, frustrates enemy timelines, cements the coalition early by its representation of national resolve and provides the capability to assure the outcome of timeline and conditions. Responsiveness and deployability will be achieved through lighter formations, reductions in deployment tonnages, improved military and civilian force projection platforms, advanced en route planning/rehearsal tools, and simplification and reduction of reception, staging, onward movement, and integration requirements. Responsiveness is also improved through force design and organizational principles---modularity, force pooling, general purpose design---that permit the commander to rapidly tailor and deploy the appropriate force for each contingency and to transition to other forms of operations when battlefield conditions change.

Effective joint operations place a premium on agility and versatility. The versatility of the Objective Force will provide the Joint Commanders with general-purpose utilities and dominance across entire spectrums of operations. Agility and versatility will enable the transition between benign and hostile environments, within and between operations, including the transition from stability and support operations to higher intensity offensive and defensive operations. Mental and physical agility supports transitions across the mission sets and enables the force to dominate all environments, threats, and terrains, enhancing operational flexibility through multifunctional application within the force. [Ref. 13]

Lethality is the sum of actions that will be taken to close with or destroy the enemy. The Objective Force will have to be able to deliver overmatching combat power

with integrated combined arms and capability at the lowest levels of the organizational design. Central to this capability is using decisive fires, maneuvers, and assault to assure complete destruction of the enemy. At the tactical level, the close combat zone will expand in size and focus toward fighting and winning beyond line of sight engagements. The freedom of maneuvers for lethal units will be provided through mobile/survivable systems and units.

Survivability will be achieved holistically through force shielding, a system of systems approach that integrates physical capabilities for survivability with the manner in which the force is employed. In the past, the Army built systems capable of surviving direct-fire hits. In contrast, survivability requires effectively integrating active and passive means of protection, combined with advanced situational understandings, mutual interaction between platforms and dismounted soldiers, greater stand-off ranges, improved avoidance and penetration protection.

The Objective Force will achieve sustainability by investing in the technologies and enablers that support focused logistics and that will truly revolutionize military logistics. Units of the Objective Force will sustain multiple operations through ultra-reliable systems, systems commonality, revolutionary power generation, higher fuel efficiency, and improved system maintainability. Sharply reduced sustainment demands, particularly for water, fuels and munitions, will reduce throughput and infrastructure requirements. As these changes are implemented, the Objective Force will retain the infrastructure and capabilities required to sustain and support the joint force in accordance with the Army's mandated joint responsibilities.

D. INTERIM FORCE

The Army's responsibility to satisfy 21st Century requirements for effective full spectrum strategic responsiveness demands an improved capability for the rapid deployment of highly-integrated, combined arms forces possessing overmatching capabilities, exploiting the power of information and human potential, and combining the advantages of both light and mechanized forces, across the full range of military operations. Meeting this requirement and providing warfighting CINCs with an important new option for contingency response is the central near-term objective of the

Army's decision to develop full spectrum medium weight brigades, known as the Interim Brigade Combat Teams (IBCTs). [Ref. 14]

Creating a limited number of reorganized IBCTs will add near term capability for strategic responsiveness, particularly regarding the Army's frequent participation in small-scale contingencies. The new IBCTs complement other existing forces to provide a full spectrum capable Army today, while the Army simultaneously builds the entire (mid-term) Interim Force and pursues Transformation to the longer-term Objective Force described in the Combat Support Activity (CSA) Vision. To be more precise, the IBCTs, operating within division structures, will provide a complementary capability to our current light and mechanized forces, serving as a bridging force and vanguard until science and technology allow the Army to achieve Objective Force capabilities. The IBCT will give the Army a quick-strike capability until it fields the first units of its Future Combat System in 2012. The remnants of the legacy force, along with the IBCT and multiplatform Future Combat System, will compromise the Army's future fighting force, the Objective Force. [Ref. 14]

The Army will rapidly and nearly simultaneously develop two initial Brigade Combat Teams during CYs 00 and 01 on the basis of two existing brigades, one heavy and one light, at Fort Lewis, Washington. Near simultaneous development will reduce costs, double the emerging capability for improved strategic responsiveness represented by the initial Brigade Combat Teams, and create an environment wherein parallel efforts based on differing organizations can inform and expedite the overall development process. Efforts to create the two initial Brigade Combat Teams will also occur in parallel with plans to generate subsequent IBCTs for the Interim Force. As a result of their accelerated development, the initial Brigade Combat Teams will also function to jump-start immediate forward progress in implementing the Army Transformation Strategy, without compromising the Army's ability to accomplish its most fundamental mission—fighting and winning the nation's wars. [Ref. 15]

E. MISSION OF INTERIM BRIGADE COMBAT TEAM

The Interim Brigade Combat Team is a full spectrum, combat force. It has utility, confirmed through extensive analysis, in all operational environments against all

projected future threats, but it is designed and optimized primarily for employment in small scale contingencies (SSC) in complex and urban terrain, confronting low-end and mid-range threats that may employ both conventional and asymmetric capabilities. Fully integrated within the joint contingency force, the IBCT deploys very rapidly, executes early entry, and conducts effective combat operations immediately on arrival to prevent, contain, stabilize, or resolve a conflict through shaping and decisive operations. The IBCT participates in a major theater war (MTW) as a subordinate maneuver component within a division or corps, in a variety of possible roles. The IBCT also participates in stability and support operations (SASO) as an initial entry force and/or as a guarantor to provide security for stability forces by means of its extensive combat capabilities. [Ref. 14]

F. INTERIM BRIGADE COMBAT TEAM OVERVIEW

The IBCT is a divisional brigade. It is designed to optimize its organizational effectiveness and balance the traditional domains of lethality, mobility and survivability, with the capabilities required for responsiveness, deployability, sustainability and a reduced in-theater footprint. Its core qualities are high mobility (strategic, operational, and tactical) and its ability to achieve decisive action through dismounted infantry assault, supported by organic direct and indirect fire platforms, and enabled by situational understanding. The major fighting components are its motorized infantry battalions. The IBCT also has a unique Reconnaissance, Surveillance and Target Acquisition (RSTA) Squadron to enhance situational understanding.

As noted in the mission statement, the Interim Brigade Combat Team is specifically designed an early entry combat force. Its likely operational environment includes a number of distinguishing features: urban/complex terrain; a weak transportation and logistical infrastructure, uncertain political situation; coalition involvement; and, the presence of an asymmetric threat including mostly mid- but some high-end technologies. To achieve a very rapid deployment threshold, the Brigade's design capitalizes on the widespread use of common vehicular platforms, particularly a highly mobile, medium-weight armored combat/combat support platform, coupled with a minimized personnel and logistical footprint in theater. Pre-configured in ready-to-fight

combined arms packages, the entire IBCT can deploy within 96 hours of “first aircraft wheels up” and begin operations immediately upon arrival at the aerial port of debarkation (APOD). In essence, the APOD is the tactical assembly area (TAA). The IBCT cannot conduct forced entry, but can provide the joint force commander an improved capability to arrive immediately behind forced entry forces and begin operations to shape the battlespace and expedite decision. Once committed, the IBCT can sustain operations for up to 180 days without relief.

IBCT organization is expandable through either augmentation or scalability in accordance with the mission, enemy, troops, terrain, time, and civilians in any given contingency. The IBCT is scaleable in terms of its ability to accept like-type additional forces to expand core tasks and functions already resident within the IBCT (e.g., adding additional infantry or RSTA organizations). The IBCT is also capable of accepting augmentation, including units or elements that execute tasks or functions not resident within the Brigade (e.g., adding armor, field artillery, air defense, additional engineers, military police, or aviation elements). In both cases, added units will execute their normal mission essential tasks and therefore will not require extensive training in order to deploy and operate with the IBCT. The organization includes the command, control, and communications (C3) “hooks” necessary to permit rapid integration of additional, enabling capabilities, particularly for operations outside the scope of SSCs, such as SASO and major theater war.

Operationally, the Interim Brigade Combat Team normally fights under a division. The IBCT can also fight under the direct control of a corps headquarters within a joint or combined command. In either case, if the employing HQ is not already in place, it must deploy lead elements of its command, control, and communications structure in order to establish the C3 framework required for effective initial operations. In many contingencies, the IBCT will (initially) be the single US maneuver command operating under the Joint Forces Land Component Command (JFLCC). The IBCT depends upon the division and higher echelons of command for reach-back linkages to expand its capabilities in information, intelligence, joint effects, force protection and

sustainment. The IBCT is also fully complementary to and compatible with air expeditionary forces and USMC forces with respect to integrated employment. [Ref. 15]

As a full spectrum combat force, the IBCT typically maintains an offensive orientation. However, depending on the nature and evolution of the contingency, it is capable of conducting all major doctrinal operations, including offensive, defensive, stability, and support operations. Its core operational capabilities rest upon excellent operational and tactical mobility, enhanced situational understanding, combined arms integration down to the company level, and high infantry dismount strengths for close combat in urban and complex terrain. Properly integrated, these core capabilities compensate for platform limitations that may exist in the close fight and enhance force effectiveness. The IBCT also reinforces force effectiveness through teaming at all echelons and a high level of training based on a Train-Alert-Deploy framework. When employed in the operational environment for which it is optimized, the IBCT has the capability to achieve early decision as a result of its rapid response, shaping, and decisive operations. [Ref. 13]

G. STRATEGIC MOBILITY

The Army has designed its own set of goals for deploying forces rapidly to regional conflicts. That plan assumes that the United States will have fewer forces abroad in the future than it did during the Cold War. The Army's focus is preparing a five-division contingency corps (with one airborne, two heavy, one air assault, and one light division) that would deploy on short notice and is capable of using force immediately upon entering a region. [Ref. 1]

Under the Army's plan, the contingency corps would face a tight delivery schedule: a ready brigade from a light division would arrive in the region of conflict four days after the start of deployments (C+4), with most of the rest of the division following by C+12. [Ref 1: p 66] One heavy brigade would be delivered by C+15 under the plan, with two reinforcing divisions (one armored plus either one mechanized or one air assault) arriving by C+30. The full five-division contingency corps plus a corps-support command would be in place by C+75. [Ref. 1:p. 66] That schedule serves as a rough guideline: the precise timing for deliveries would vary depending on the scenario at hand.

In the case of a conflict in the Persian Gulf, for example, the Army has set an even tougher timeline--it plans to have an entire heavy division in place within the first two weeks of deployments. Given competing demands for transportation at the start of a conflict, there would not be enough planes to deliver even a heavy brigade that quickly by airlift alone. For that reason, the Army is prepositioning heavy equipment and some support units in the Gulf region. [Ref. 1]

To give a sense of the scope of the Army's mobility requirements, Table 8 shows the average number of airlift sorties or shiploads required to transport parts of a notional contingency corps. For example, an airborne division would need 1,101 C-141 and 78 C-17 sorties--or nearly three large, medium-speed roll-on/roll-off shiploads--to move its equipment and accompanying supplies. [Ref.13] (All units would require some C-17s or C-5s to move their outsize cargo, but the remaining equipment could be flown on C-141s.) Although Table 8 shows information for a notional corps-support command, it does not reflect all the corps-level units and support units for echelons above corps that would deploy, such as air defense, artillery, some headquarters units and additional aviation brigades. Thus, lift requirements for an entire corps would be much larger than the sum of the units shown. [Ref. 1]

Notional Army Unit	Number of Personnel	Unit Weight (Tons)	Airlift Sorties (C-141/C-17 mix) ^a	Number of LMSRs ^b
Airborne Division	13,242	26,699	1,101/78	2.8
Air Assault Division	15,840	35,860	1,412/195	3.9
Armored Division	17,756	110,431	1,761/1,274	6.2
Mechanized Division	17,982	109,116	1,708/1,275	6.2
Light Infantry Division	11,036	17,092	769/41	1.8
Corps-Support Command	22,410	98,717	3,599/500	8.5

Table 8. Approximate Lift Requirements for Army Contingency Forces.

SOURCE: Congressional Budget Office based on Department of Defense, Military Traffic Management Command, Deployment Planning Guide, 94-700-5 (Newport News, Va., September 1994).

NOTE: Based on data from the Army's April 1994 Tables of Organization and Equipment. Actual deployment values will be different for specific units and scenarios. Estimated weights include accompanying supplies, equipment, and ammunition.

a. The number of C-141 and C-17 sorties required to move each unit's equipment based on simulations of aircraft loading. Although the sorties shown would move some of the unit's personnel, additional passenger sorties by Civil Reserve Air Fleet planes would be necessary.

b. The number of large, medium-speed roll-on/roll-off ships required to transport each unit, assuming minimum containerization of unit equipment.

For major conflicts, the Army's need for strategic mobility surpasses that of the other military services. That requirement appears to hold true both in the early stages of a conflict and over an entire deployment.

Consider the Persian Gulf War, for example. During August 1990, the Army accounted for about 43 percent (by weight) of all the equipment for early-deploying units that was sent by airlift, fast sealift, and prepositioning ships. The Marine Corps was responsible for the next largest share, about 35 percent, primarily because its Maritime Prepositioning Ships arrived on the scene early. Air Force cargo, which moved almost entirely by airlift, accounted for almost all of the remaining 22 percent. [Ref. 1]

For a major conflict in the future, defense planners believe that Army forces will constitute about 77 percent of DoD's total workload for strategic mobility forces. The Army's share of the mobility workload would be somewhat lower in the early part of a deployment, when Air Force and Marine Corps units were moving quickly to the theater. But the Army requires a large number of combat-support and combat-service-support units, many of which would deploy later in a contingency (Figure 4).

The Army wants the IBCT to include some of the firepower of its heavy legacy forces, like Abrams tanks, and the speed of its airborne troops or light forces. The service's heavy forces currently take up to 30 days to get to battle by ship. The Air Force would have to use three aircraft to move the IBCT, including C-130Js for in-theater missions, and the C-5 and C-17 aircrafts for long distance transport. To move an IBCT brigade of 360 armored vehicles, 1,183 C-130J sorties are required. Studies are currently underway to determine what combination of C-5s, C-17s and C-130s will be required to move one IBCT into combat. [Ref. 14]

In order to describe how a major military deployment takes place, it is important to understand a few basic terms about military forces.

Army Divisions and Brigades. U.S. Army forces are organized into units of various sizes. Larger-size units include brigades, divisions, and corps. Brigades usually consist of 3,000 to 5,000 soldiers from two to five smaller units (called battalions). Divisions are typically composed of three brigades plus additional units in charge of command and control, field artillery, engineering, aviation support, air defenses, and the like. An Army unit that is fully capable of synchronizing and sustaining combat operations is called a corps. Corps typically includes two or more divisions plus additional units that help to command combat forces and provide logistical support. In a major conflict, the Army might also deploy echelons above corps—additional units that conduct activities such as providing ballistic missile defenses for all U.S. troops in a theater.

Light and Heavy Units. Army units are described as heavy or light depending on how many tanks, armored vehicles, and other pieces of heavy equipment they include. Armored and mechanized divisions are examples of heavy units. Airborne and light infantry units are designed to be light enough to be transported by air.

Combat Arms, Combat Support, and Combat Service Support. The Army refers to those units that would be directly involved in fighting a conflict as combat arms. Armored, infantry, and attack-helicopter units are some examples. Forces that provide operational assistance to combat arms are known as combat-support units. They include military intelligence; military police; chemical, engineering, and signal forces; and some aviation units. Combat-service-support units perform logistics and administrative functions such as those of quartermasters, transportation specialists, and medical professionals.

Air Force Wings. U.S. Air Force tactical aircraft are organized into wings of approximately 72 planes, with most wings composed of just one type of plane.

Marine Expeditionary Forces. The U.S. Marine Corps is organized into task forces of various sizes, each of which includes both ground and air elements. The largest of those units is the Marine expeditionary force (MEF). The lead elements of a MEF are designated as a MEF (Forward) a reinforced infantry regiment supported by a Marine air group.

Navy Forces. U.S. Navy ships are organized into task forces of various sizes as the occasion demands. In general, Navy forces tend to carry their own combat equipment, personnel, and logistical support. As a result, the Navy requires relatively little support from mobility forces for moving dry cargo.

Figure 4. Types of Military Forces: A Summary.

Since airlift is the most costly mode of transportation, how much of it each service requires is important. During the first month of the Persian Gulf War, Army units (troops and equipment) accounted for some 46 percent, by weight, of all airlift deliveries. The Air Force required about a quarter of early airlift deliveries to set up aerial port operations, establish bases from which to operate aircraft and deploy tactical fighter wings. Likewise, the Department of the Navy (which includes Marine forces) accounted for another quarter of airlift deliveries in August 1990. Over the entire Gulf War

deployment, Army equipment made up the largest share of airlift deliveries, followed by Air Force and then Marine Corps cargo. [Ref. 1]

Because the Army represents the bulk of what the United States would deploy to a major contingency, the physical characteristics of Army equipment--its shape and weight--are critical factors for mobility planning. Over time, the weight and square footage of Army units have grown significantly as the service has modernized and reorganized its forces. In 1994, for example, a mechanized division was about 49 percent heavier and took up 17 percent more floor space than the same type of division structured under 1987 guidelines. On average, most types of Army units have grown in square footage by at least 2 percent a year since 1987 and grown in weight by more than 4 percent a year. [Ref. 1]

The Army's larger "footprint" reflects the fact that some of today's equipment is more capable and better able to survive enemy forces. But the larger weight of Army units unquestionably poses a bigger burden for mobility forces. Recognizing that burden, many mobility experts have urged designers to pay more attention to a weapon system's "transportability" when designing new equipment.

H. AIRLIFT COULD BE NEEDED FOR SPECIAL MISSIONS

Because of the cost of airlift, DoD's major planning scenarios anticipate that most equipment for a conflict would already be prepositioned or would arrive by sealift. However, airlift would be more effective. One reason is that transport planes can deliver cargo to locations that do not have access to ports or railroads. Also, for lighter forces, airlift planes deliver equipment much more quickly than can sealift ships. Moreover, airlift is a quick means of delivering cargo to missions such as humanitarian relief operations or transporting military equipment to U.S. forces deployed abroad. But another reason is that some transport aircraft perform special military missions that some defense officials consider important. Whether the United States is willing to pay the higher cost for those capabilities is subject to debate. [Ref. 2]

Probably the most notable special mission is large-scale, intercontinental airdrop operations. The Army is required to be able to insert brigade-size forces quickly into any region of the world--even countries that are beyond the range of most cargo planes

without refueling. During such a mission, airlift planes would drop troops and their equipment by parachute; the troops would then seize control of an airfield and prepare it to receive reinforcements quickly. Since the initial forces would be deploying into hostile territory, military planners set very tight timelines for airdrops. But the United States has used airdrop operations sparingly in the past, especially when paratroopers would need to deploy over long distances; the last time DoD dropped a brigade-size force outside the Western Hemisphere was during the Vietnam War. [Ref. 2]

Nevertheless, the Army's requirement to prepare for long-range, large-scale airdrops is a key factor in DoD's plans for procuring airlift planes. Only a few types of military transports can be used to drop parachutists. For regions that are closer to the United States, airlift planes could conduct an initial airdrop and then return to the United States to pick up additional loads. For longer-range deployments, however, DoD would need larger numbers of strategic airlift planes to conduct an airdrop and also complete deliveries within the demanding timelines laid out by military planners.

I. CONCLUSION

The development of an Interim Brigade Combat Team will make immediate improvements in the strategic responsiveness of Army ground forces. The IBCTs will enhance the ability of joint force commanders to respond to opportunity and uncertainty. Equally, the development of the IBCTs will represent a clear near term improvement in national and theater conventional deterrence, providing national command authorities the capability to place a credible, visible, and flexible combat force on the ground anywhere in the world within 96 hours.

Improving the Army's future strategic responsiveness is a greater challenge due to the difficulties involved in accurately predicting future threats and the clear requirements for ever more linked and integrated joint requirements. The greatest value the Army's Objective Force concept could provide is its role in forcing rapid resolution and detailed definition of future joint fighting concepts and requirements. The danger of proceeding with Objective Force requirements is that the Army could develop the wrong Objective Force and meet the Army's requirement, but not be able to meet the requirements that

require other joint forces in assuring that the troops and equipment are able to get to the fight. This deficiency could lead to further shortfalls in capability.

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V. CONCLUSION AND RECOMMENDATIONS

A. CONCLUSIONS

The following are specific conclusions that have been drawn from this study:

1. **The air mobility capabilities are insufficient to support AMC's requirements and a steady-state operational requirement.**

This study found that the current force structure does not support the requirements that are imposed by the MRS BURU, nor can the transformation of the Army's Objective Force, be supported by the number of airlifters in the force today.

In addition to the MTM/D estimates that indicate a shortage of strategic airlift, time phased force deployment data has also shown that our requirements supersede current and future capabilities. The inability to meet timeline requirements and to handle peak demands within deployment and sustainment operations is clearly a problem posed by the time-phased deployment. A likely alternative to minimize airlift requirements is to reduce overall airlift deployment/sustainment operations by using fast sealift or prepositioning.

2. **The inadequacy of AMC's current force structure and the C-17 acquisition program is likely to decrease the shortfalls identified.**

A sufficient number of new airframes replace the older airframes that are being retired. The numbers that are being identified for the C-17 will face insurmountable challenges in attempting to satisfy the requirements of steady-state operations.

U.S. strategic airlift forces are modernizing to meet current and future airlift challenges. The C-17 is the crucial link to the change in capabilities. The problem lies in the number of C-17s that will ultimately be produced to meet the national military requirement. The current production cap of 120 C-17s is not based on requirements; it is based on budgetary constraints. As our forces evolve around constrained budgets, matching capabilities with the National Security Strategy becomes a problem. The budget decision to build only 120 C-17s is inconsistent with the national security strategy and should be changed to support the policy. If we want to keep our capabilities in line with

strategy of the Mobility Requirement Study, its recommendation to increase the C-17 should be considered to meet the capability requirements.

3. Developing the Interim Brigade Combat Teams will immediately improve the strategic responsiveness of Army ground forces.

The IBCTs will constitute an important new option for warfighting CINCs as a decisive contingency response. At the operational level, IBCTs will sharply enhance the joint force commander's ability to respond to opportunity and/or uncertainty. Equally important, IBCTs will represent a clear near term improvement in national and theater conventional deterrence, providing national command authorities the capability to place a credible, visible, and flexible combat force on the ground anywhere in the world within 96 hours. Finally, the accelerated development of the initial two BCTs will jump-start the Army Transformation Strategy without compromising the Army's ability to accomplish its most fundamental mission.

To get our troops to the theater more quickly requires faster throughput. The force protection process consists of modes of transportation (air, sea, and surface) punctuated with intermodal nodes. Within the theater, the future airframes must be as common as the tactical truck on the battlefield. The Army must take a hard look at its forces and structure to include new aerial platforms to support in-theater distribution, medical evacuation, reconnaissance, or personnel. These vehicles will have to complement and replace high mobility, multiuse vehicles currently in the legacy force.

B. RECOMMENDATIONS

The following recommendations aim to outline modifications for the air mobility force structure to more effectively achieve its mission and the NSS objectives to operate in a strategic environment.

1. Force Structure Development

Air mobility forces should increase strategic airlift capability by increasing the number of C-17s. To transport the required outsized and oversized cargo, AMC must increase its organic airlift capability. Commercial carriers are too small and require additional onloading and off-loading equipment to transport outsized and oversized

cargo. The new airlifter, if properly programmed, will achieve the requirements imposed by the strategic objectives, while reducing support required.

2. Airframe Upgrades

Continuing current upgrade programs will bring mobility air forces up to requirements. These programs enable the older aircraft to conform to aviation regulations, meet mission capable levels and operate in today's strategic environment. The up-grade programs address the short-term requirements of maintaining the air mobility capabilities to operate in the nations worldwide. They also lengthen the lifespan of the C-5 and KC-135 order to meet both strategic airlift and aerial refueling requirements of the air mobility force.

3. Commercial Carriers

Reliance on commercial air carriers to supplement the military air mobility force structure by transporting passengers and bulk cargo helps reduce the expense of air mobility operations. Commercial air carriers use civilian infrastructure to transport passengers and cargo. Military passenger and cargo airlift requirements exceed the capability that DoD can afford to buy. The Air Force can continue to promote the production of a commercial C-17 version, which would add substantially more capability to the Civil Reserve Air Fleet (CRAF). The commercial sector is creating new opportunities in the global transportation market by developing a class of aerial transport vehicles that can deliver greater tonnage, such as ultra-large aircraft concepts and prototypes. These new heavy lifters would satisfy the commercial need to move goods to market more quickly. Military interface requirements could be incorporated into the initial commercial design.

4. Long Range Airlifters

The next generation heavy lifters should include the Advanced Tactical Transport to replace the C-130 fleet. The Army should invest in advanced tactical transport with the capability for large heavy cargo and very short take-off and landing. Investing in this aircraft allows DoD to retire the legacy C-130 systems within the next 10 to 15 years.

5. Objective Force Development

The Army intends to synchronize the evolution of today's Army to the Objective Force, while ensuring the capability to support national security requirements at all times. The Army will need to rely on legacy forces, composed of the Army's current warfighting organizations, to meet these requirements. At the same time, the Initial Brigade Combat Teams will validate an operational and organizational prototype for the Interim Force. Conversion to this Interim Force design will expand until science and technology can provide the desired long-term systems.

Implementing the Army's Vision has a significant personnel dimension. The Army will need to continue to train and equip its people. The transformation of the Institutional Army, along with careful analysis of Army personnel requirements, will support the new distribution of personnel and identify any mismatch between requirements and congressionally mandated end strength.

The Army's transformation is conditions-based, which means the pace of the transformation is not preordained. At every step, the decision to progress to the next stage will depend on the determination that all necessary preconditions have been met. The first essential condition that will be met at every step is to sustain the capabilities to meet the Nation's security requirements.

C. SUMMARY

Air Mobility has changed. Today's strategic environment is evolving, based on newly identified requirements for capabilities. To achieve the diverse objectives established by the NSS, we must employ mobility forces for a range of operations more so now than in the past. The new air mobility force structure should reflect the new requirements and create a force structure that can achieve national goals.

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